SonoSite

C1.75 Ultrasound System

Service Manual

P01118-03 01/2003
Copyright 2003 by SonoSite, Inc.
All rights reserved. Printed in the USA.

Manufactured by
SonoSite, Inc.
21919 30th Drive SE
Bothell, WA 98021-3904
USA
Telephone: 1-888-482-9449 or +1-425-951-1200
Fax: +1-425-951-1201

SonoSite European Headquarters
Baystrait House, Station Road
Biggleswade SG18 8AL
UK
Telephone: +44-1767-313-117
Fax: +44-1767-312-400

CAUTION:

- United States federal law restricts this device to sale by or on the order of a physician.

"SiteCharge," "SitePack," "SiteStand," and "SonoHeart," are trademarks of SonoSite, Inc.

Non-SonoSite product names may be trademarks or registered trademarks of their respective owners.

SonoSite products may be covered by one or more of the following U.S. patents: 4454884, 4462408, 4469106, 4474184, 4475376, 4515017, 4534357, 4542653, 4543960, 4552607, 4561807, 4566035, 4567895, 4581636, 4591355, 4603702, (4607642), 4644795, 4670339, 4773140, 4817618, 4883059, 4887306, 5016641, 5050610, 5095910, 5099847, 5123415, 5158088, 5197477, 5207225, 5215094, 5226420, 5226422, 5233994, 5255682, (5275167), 5287753, 5305756, 5353354, 5365929, 5381795, 5386830, 5390674, 5402793, (5,423,220), 5438994, 5450851, 5456257, 5471989, 5471990, 5474073, 5476097, 5479930, 5482045, 5482047, 5485842, 5492134, 5517994, 5529070, 5546946, 5555887, 5603323, 5606972, 5617863, (5634465), 5634466, 5636631, 5645066, 5648942, 5669385, (5706819), 5715823, 5718229, 5720291, 5722412, 5752517, 5762067, 5782769, 5800356, 5817024, 5833613, 5846200, 5860924, 5893363, 5916168, 5951478, 6036643, 6102863, 6104126, 6113547, 6117085, 6142946, 6203498 B1, D0280762, D0285484, D0286325, D0300241, D0306343, D0328095, D0369307, D0379231. Other patents pending.

Table of Contents

CHAPTER 1 **Introduction** 1

1.1 Description 1
1.2 System Components 1
1.3 Audience 2
1.4 Conventions Used in This Manual 2
1.5 About the System Software 3
1.6 Software Licensing 3

CHAPTER 2 **Safety** 5

2.1 Electrical Safety 5
2.1.1 Equipment Protection 7
2.2 Battery Safety 7
2.3 Biological Safety 8
2.4 Labeling Symbols 9

CHAPTER 3 **System Overview** 11

3.1 Theory of Operation 11
3.1.1 Transducer 12
3.1.2 Acquisition Subsystem 12
3.1.3 Processing Subsystem 12
3.1.4 Display Subsystem 12
3.1.5 Control Subsystem 12
3.1.6 User Interface Subsystem 12
3.1.7 Power Subsystem 13
3.2 Components 13
3.3 Controls 13
3.4 Accessories 15
3.4.1 SiteStand Mobile Docking Station 15
3.4.1.1 SiteLink Image Management Software 16
3.4.1.2 IrfanView Software 16
3.4.2 SiteStand Display 16
3.4.3 SiteCharge Dual Battery Charger 18
3.4.4 SitePack Protective Carry Pack 18
3.4.5 Battery Pack 19
3.4.5.1 Battery Charge Indicators 19
3.4.6 External Power 19

3.4.6.1 External System Connections 20
3.4.7 Power Adapter 20
3.4.8 Cables 21
3.4.8.1 Video 21
3.4.8.2 Printer Control 21
3.4.8.3 AC Power Extension 21
3.4.9 Video 21
3.4.9.1 Video Port Cable 22
3.5 System Specifications 22
3.5.1 Physical Dimensions 22
3.5.2 Monitor 22
3.5.3 Transducers 22
3.5.4 Imaging Modes 22
3.5.5 Image Storage 23
3.5.6 Temperature and Humidity Limits 23
3.5.6.1 System Operating 23
3.5.6.2 System Shipping/Storage 23
3.5.6.3 Battery Operating 23
3.5.6.4 Battery Shipping/Storage 23
3.5.6.5 Transducers Operating 23
3.5.6.6 Transducers Shipping/Storage 23
3.5.7 Electrical 23
3.6 Battery 24
3.7 Safety Requirements 24
3.7.1 Meets Electromechanical Safety Standards 24
3.7.2 Meets EMC/EMI Standards 24
3.7.3 Meets Airborne Equipment Standards 25

CHAPTER 4 **Setup and Operation** 27

4.1 Connecting and Removing Transducers 27
4.2 Removing and Installing the Battery 28
4.3 Turning the System On and Off 29
4.4 Using AC Power 30
4.5 Upgrading the System Software 31
4.6 Obtaining A License Key 32
4.6.1 Installing A License Key 33
4.6.1.1 Displaying the System Information Screen 34
4.7 Checking and Charging the Battery 35
4.8 Using the SiteCharge Dual Battery Charger 37

4.9 Using System Setup 38
4.9.1 Setting the Date and Time 39
4.9.2 Setting the Sleep Delay 39
4.9.3 Setting the Power Delay 39
4.9.4 Setting the Audible Beep 39
4.9.5 Setting Up A Recommended Printer 40
4.9.6 Setting Up A Recommended VCR 40
4.9.7 Setting Up A Recommended Video Monitor (External) 41
4.9.8 Setting Up Function Key Assignments 41
4.9.9 Changing All System Setups to the Default Settings 41

CHAPTER 5 **Cleaning and Disinfecting** 43

5.1 Universal Precautions 43
5.2 Receipt of Suspected Contaminated Materials 43
5.3 Recommended Disinfectants 44

CHAPTER 6 **Troubleshooting** 45

6.1 System and Subsystem Diagnosis 45
6.2 Subassembly Replacement 45
6.3 Test Equipment 45
6.4 Failures 46
6.4.1 Display 46
6.4.2 Control Panel 46
6.4.3 Trackball 46
6.4.4 Main PCBA 46
6.4.5 Clearing the Main PCBA Failure 47
6.4.6 Battery 47

CHAPTER 7 **Replacement Procedures** 55

7.1 Display 55
7.1.1 Required Parts 55
7.1.2 Required Tools and Materials 55
7.1.3 Removing the Display 56
7.1.4 Replacing the Display 58
7.2 Control Panel 60
7.2.1 Required Parts 60
7.2.2 Required Tools 60
7.2.3 Removing the Control Panel 60
7.2.4 Replacing the Control Panel 63

7.3 Trackball 64
7.3.1 Required Parts 64
7.3.2 Required Tools 64
7.3.3 Removing the Trackball 64
7.3.4 Replacing the Trackball 67
7.4 Main PCBA 69
7.4.1 Required Parts 69
7.4.2 Required Tools 70
7.4.3 Removing the Main PCBA 70
7.4.4 Replacing the Main PCBA 71
7.5 Transducers 74
7.6 SiteCharge Dual Battery Charger 74
7.7 AC Power Adapter 74
7.8 Peripherals 75
7.8.1 Display 75
7.8.2 VCR 75
7.8.3 Printer 75

CHAPTER 8 **Performance Tests** 77

8.1 Overview 77
8.2 Test Equipment: 77
8.3 Setting Up Performance Tests 78
8.3.1 Scan Reference Orientation 78
8.4 Testing 2D Performance 78
8.4.1 2D Image Quality 78
8.4.2 Axial Measurement Accuracy 79
8.4.3 Lateral Measurement Accuracy 79
8.4.4 Penetration 80
8.5 Additional Performance Tests 80
8.5.1 CPD 80
8.5.2 PowerMap DCPD 81
8.5.3 Image Quality Verification Test 81
8.5.4 Image Review 81
8.5.5 Printer 82
8.5.6 Battery Charging 82
8.5.7 Video Output 82
8.6 Returning Products to SonoSite 83
8.6.1 Contacting SonoSite Technical Support 83
8.6.2 Shipping Instructions 83

APPENDIX A **Parts List** 85

APPENDIX B **Service Event Report** 97

Index 99

CHAPTER 1

Introduction

Before servicing the SonoSite ultrasound system, read and be familiar with the information in this manual. This manual is applicable to SonoSite products manufactured after June 23, 2000. For more information about products manufactured prior to June 23, 2000, please refer to *SonoSite Service Manual (P00715-02)*.

1.1 Description

The SonoSite system is a portable, software-controlled, ultrasound system, which has an all-digital architecture. It is used to acquire and display high-resolution, real-time, 2D, Color Power Doppler (CPD), and PowerMap (PM) Directional Color Power Doppler (DCPD) ultrasound images. The system has cine review, image zoom, labeling, biopsy, measurements and calculations, image storage and review, printing and recording capabilities.

Currently, the system supports the following broadband transducers:

- C60/5-2 MHz 60-mm, curved array
- C15/4-2 MHz 15-mm, curved array
- ICT/7-4 MHz 11-mm, intracavitary array
- L38/10-5 MHz 38-mm, linear array

1.2 System Components

The SonoSite system comprises the following components:

- a hand-carried ultrasound system
- a transducer
- a power adapter

The SonoSite system may include the following optional accessories:

- SiteStand mobile docking station
- SiteStand display
- SiteCharge dual battery charger
- SiteLink software
- ScanPack quick access carrier
- SitePack protective carrying case
- Power adapter (extra)
- Battery (extra)
- Video cables (3)
- Printer control cable
- Power cord
- AIUM Ultrasound Medical Safety Guidance document
- *SonoSite 180 or SonoHeart User Guide*

1.3 Audience

The intended audience of this manual is properly trained field and in-house service personnel.

1.4 Conventions Used in This Manual

These conventions are used in this manual:

- Control names and references to display elements are presented in **bold-face** type.
- Operating instructions are introduced with a statement in **bold-face** type that ends with a colon. For example: **To read this user guide:**
- When the steps in the operating instructions must be performed in a specific order, the steps are numbered.
- Bulleted lists present information in a list, they do not imply a sequence.
- Screen display text is shown in Arial 10 pt. For example: Successful upgrade.
- The left side of the system is to your left as you face the system. The system handle is at the top of the system, the battery compartment is at the bottom of the system.
- *Note: A note draws attention to information that is a general rule for a procedure or is an exception to a rule (noncritical information of general interest).*

1.5 About the System Software

The SonoSite system contains software that controls its operation. From time to time, SonoSite provides new software for use with the system.

Transducers that you receive from SonoSite may include new software for the SonoSite system. This software may be either required or optional.

When the new software is required, you must install it if you wish to use the new software features (e.g., new transducer). If you choose not to install it, you must remove the transducer and replace it with one that is compatible with the software that is currently installed in the system.

When the software is optional, you can either install it or choose to use the existing software. If you choose not to install the software, the system will prompt you again whenever the system is started, and whenever the transducer is disconnected and then reconnected to the system. For more information on software upgrades, refer to **Chapter 4.5, *Upgrading the System Software,*** on page 31.

1.6 Software Licensing

Use of the software that you receive from SonoSite is controlled by a license key. A license key is a number sequence containing exactly 12 decimal digits.

License keys are obtained from SonoSite or from its authorized representatives. You must obtain one license key for each system that will use the new software. Refer to **Chapter 4.6, *Obtaining A License Key,*** on page 33 for information on obtaining a license key.

Software that you receive from SonoSite may be installed and will operate for a short period of time without requiring a valid license key. We refer to this period of time as the "grace period." The grace period is variable.

When you first install the software, the SonoSite system will prompt you for a license key. If you have not yet obtained a valid license key, you can elect to use the software as long as the grace period time has not been fully consumed. We refer to this mode of operation as "running in the grace period."

When the system is running in the grace period, all system functions are available. As you use the system, the grace period is slowly consumed. When the grace period has expired, the system will not be usable until a valid license key has been entered. Grace period time is not consumed while the system is powered off or when it is in "sleep" mode. Whenever the system is running in the grace period, the grace period time remaining is available on the license update screen. For information on displaying the license update screen, refer to **Chapter 4.6.1.1, *Displaying the System Information Screen,*** on page 35.

CAUTION:

- When the grace period expires, all system functions except for licensing will become unavailable until a valid license key is entered into the system.

CHAPTER 2

Safety

Please read this information before using the SonoSite ultrasound system. It applies to the ultrasound system, transducers, peripherals, and accessories.

A ***WARNING*** describes precautions necessary to prevent injury or loss of life.

A ***CAUTION*** describes precautions necessary to protect the products.

2.1 Electrical Safety

This system meets EN60601-1, Class I/internally-powered equipment requirements and Type BF isolated patient-applied parts safety requirements.

This system complies with the applicable medical equipment requirements published in the Canadian Standards Association (CSA), European Norm Harmonized Standard, and Underwriters Laboratories (UL) safety standards. See **Chapter 3.5, *System Specifications,*** on page 22.

For maximum safety observe the following warnings and cautions:

WARNINGS:

- Under certain circumstances, the transducer connector and back of the display enclosure can reach temperatures that exceed EN60601-1 limits for patient contact, therefore only the operator shall handle the system. This does not include the transducer face. Patient contact with hot surfaces may result in discomfort or minor risk of patient injury.
- To avoid discomfort or minor risk of operator injury when handling the transducer connector, the system should not be operated for more than 60 minutes continuously in a live-scan mode (as opposed to freeze or sleep modes).
- Do not operate the system in the presence of flammable gasses or anesthetics. Explosion can result.

- Shock hazards exist if the AC power adapter is not properly grounded. Grounding reliability can only be achieved when equipment is connected to a receptacle marked “Hospital Only,” “Hospital Grade,” or the equivalent. The grounding wire must not be removed or defeated.
- To avoid the risk of electrical shock, before using the transducer, inspect the transducer face, housing, and cable. Do not use the transducer, if the transducer or cable is damaged.
- To avoid the risk of electrical shock, always disconnect the AC power adapter from the system before cleaning the system.
- To avoid the risk of electrical shock, do not use any transducer that has been immersed beyond the specified cleaning or disinfection level. Refer to the *SonoSite Ultrasound System User Guide* for cleaning and disinfection levels.
- To avoid the risk of electrical shock and fire hazard, inspect the AC power adapter cord and plug on a regular basis. Ensure they are not damaged.
- Connection of peripherals not recommended by SonoSite could result in electrical shock. Avoid electrical shock hazards by using peripherals and accessory cables recommended by SonoSite.
- To avoid the risk of electrical shock, use commercial grade peripherals recommended by SonoSite on battery power only. Do not connect these product to AC mains power when using the system to scan or diagnose a patient/subject. Call SonoSite technical support or your local representative for a list of the commercial grade peripherals available from or recommended by SonoSite.
- The transducer must be removed from patient contact before the application of a high-voltage defibrillation pulse.
- To avoid the risk of electrical shock to the patient/subject, do not touch the system battery contacts while simultaneously touching a patient/subject.

CAUTIONS:

- Although your system has been manufactured in compliance with existing EMI/EMC requirements, use of the system in the presence of an electromagnetic field can cause degradation of the ultrasound image. If this occurs often, SonoSite suggests a review of the system environment. Identify and remove the possible sources of the emissions or move your system.
- Electrostatic discharge (ESD), or static shock, is a naturally occurring phenomenon. ESD is common in conditions of low humidity, which can be caused by heating or air conditioning. Static shock is a discharge of the electrical energy from a charged body to a lesser or non-charged body. The degree of discharge can be significant enough to cause damage to a transducer or an ultrasound system. The following precautions can help reduce ESD: anti-static spray on carpets, anti-static spray on linoleum, and anti-static mats.
- Do not use the system if an error message appears on the image display: note the error code; call SonoSite technical support or your local representative; turn off the system by pressing and holding the power switch until the system powers down (6-10 seconds).
- To avoid increasing the system and transducer connector temperature, do not block the airflow to the ventilation holes on the back of the system.

2.1.1 Equipment Protection

To protect your ultrasound system, transducer, and accessories, follow these precautions.

CAUTIONS:

- Excessive bending or twisting of cables can cause a failure or intermittent operation.
- Improper cleaning or disinfecting of any part of the system can cause permanent damage. For cleaning and disinfecting instructions, see refer to the *SonoSite Ultrasound System User Guide*.
- Do not submerge the transducer connector in solution. The cable is not liquid-tight beyond the transducer connector/cable interface.
- Do not use solvents such as thinner or benzene, or abrasive cleaners on any part of the system.
- Remove the battery from the system if the system is not likely to be used for some time.
- Do not spill liquid on the system.
- The top membrane of the phantom is delicate and can be damaged if handled improperly. Only use minimum force when coupling the transducer to the phantom.
- Do not handle PCBs without proper static protection. Damage to components may result from improper handling.
- Damage to the system may occur if the system is incorrectly assembled, configured or the system is connected to an improper power source.
- Do not touch the scanhead connector pins.

2.2 Battery Safety

Observe the following, to ensure that the battery does not burst, ignite, or generate heat or fumes.

WARNINGS:

- The battery has a safety device. Do not disassemble or alter the battery.
- Charge the batteries only when the ambient temperature is between 32° and 104° F (0° and 40° C).
- Do not short-circuit the battery by directly connecting the positive and negative terminals with metal objects.
- Do not heat the battery or discard it in a fire.
- Do not expose the battery to temperatures over 140° F (60° C). Keep it away from fire and other heat sources.
- Do not charge the battery near a heat source, such as a fire or heater.
- Do not leave the battery in direct sunlight.
- Recharge the battery only with the SiteCharge dual battery charger or the system.
- Do not pierce the battery with a sharp object, hit it, or step on it.
- Do not use a damaged battery.
- Do not solder a battery.

- When connecting the battery to the SiteCharge dual battery charger or to the system, never reverse the polarity of the battery terminals.
- The polarity of the battery terminals are fixed and cannot be switched or reversed. Do not force the battery into the system or the SiteCharge dual battery charger.
- Do not connect the battery to an electrical power outlet.
- Do not continue recharging the battery if it does not recharge after two successive six hour charging cycles.

CAUTIONS:

To avoid the battery bursting, igniting, or fumes from the battery, observe the following precautions.

- Do not immerse the battery in water or allow it to get wet.
- Do not put the battery into a microwave oven or pressurized container.
- If the battery leaks or emits an odor, remove it from all possible flammable sources.
- If the battery emits an odor or heat, is deformed or discolored, or in any way appears abnormal during use, recharging or storage, immediately remove it and stop using it. If you have any questions about the battery, consult SonoSite technical support or your local representative.
- Store the battery between -4° F and 140° F (-20° C and 60° C).
- Use only SonoSite batteries.

2.3 Biological Safety

Observe the following precautions related to biological safety.

WARNINGS:

- Non-medical (commercial) grade peripheral monitors have not been verified or validated by SonoSite as being suitable for diagnosis.
- Do not use the system if it exhibits erratic or inconsistent behavior. Discontinuities in the scanning sequence are indicative of a hardware failure that must be corrected before use.
- Do not use the system if it exhibits artifacts on the LCD screen, either within the clinical image or in the area outside of the clinical image. Artifacts are indicative of hardware and/or software errors that must be corrected before use.
- Some transducer covers contain natural rubber latex and talc, which can cause allergic reactions in some individuals. Refer to the FDA Medical Alert, March 29, 1991.
- Perform ultrasound procedures prudently. Use the ALARA (as low as reasonably achievable) principle.
- SonoSite does not currently recommend a specific brand of acoustic standoff.

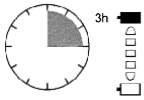
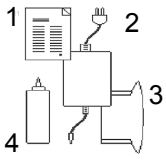
2.4 Labeling Symbols

Table 2.1 lists the symbols that are found on the products, packaging, and containers.

Table 2.1 Labeling Symbols

SYMBOLS	DESCRIPTION
SYMBOLS	DESCRIPTION
	Do not get wet
	Type BF patient applied part (B = body, F = floating applied part)
	Type CF patient applied part (C = cardiac, F = floating applied part)
	Indoor use only
	Storage temperature conditions
	Direct Current (DC)
	Alternating Current (AC)
	CE marking indicating Manufacturers declaration of compliance with Annex VII of 93/42/EEC
	CE marking indicating compliance with Annex II or Annex V and VII of 93/42/EEC certified by the British Standards Institution
	Underwriter's Laboratories labeling
	Canadian Standards Agency
REF	Catalog number
SN	Serial number type of control number
LOT	Batch code, date code, or lot code type of control number

Table 2.1 Labeling Symbols, *Continued*

SYMBOLS	DESCRIPTION
	Collect separately from other household waste (see European Commission Directive 93/86/EEC). Refer to local regulations for disposal
	Attention, see the User Guide
	Fragile
	Date of manufacture
	Caution: hot surface
5	Do not stack over 5 high
10	Do not stack over 10 high
	Paper Recycle
IPX 7	Submersible. Protected against the effects of temporary immersion
	Charge battery for 3 hours.
	User Guide (1) Power supply (2) Battery (3) Ultrasound gel (4)
	Electrostatic sensitive devices.

CHAPTER 3

System Overview

3.1 Theory of Operation

The SonoSite ultrasound system has seven major functional groups: the transducer, the acquisition subsystem, the processing subsystem, the display subsystem, the control subsystem, the user interface subsystem, and the power subsystem. Figure 3.1 shows how these functional groups interact.

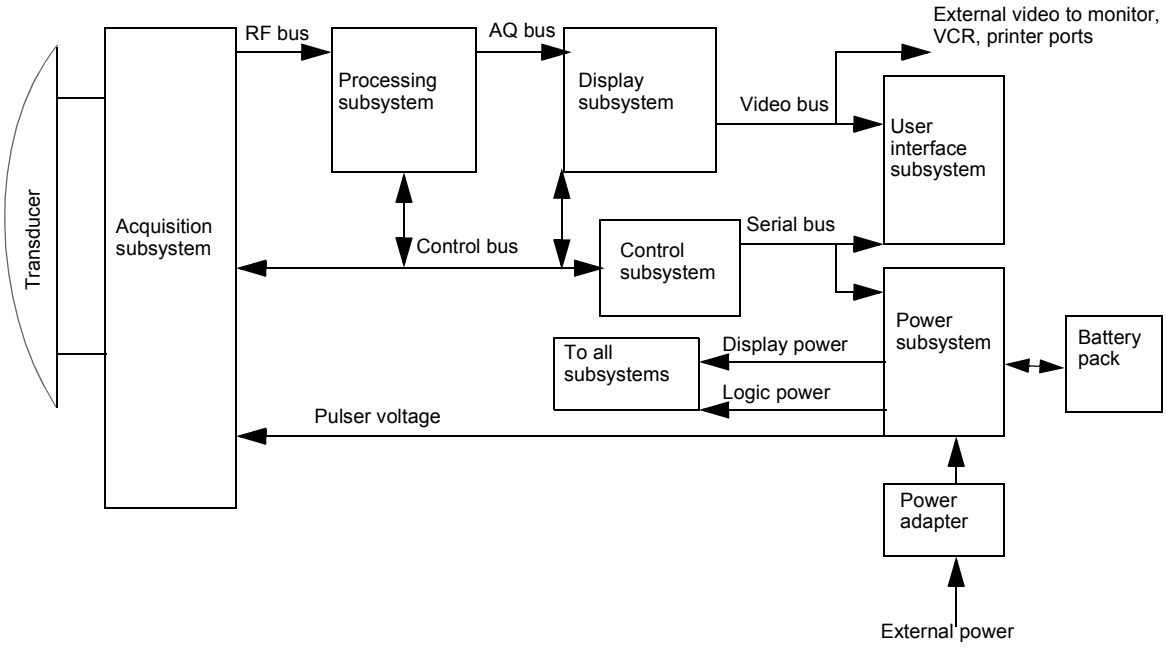


Figure 3.1 System Block Diagram

3.1.1 Transducer

The transducer elements convert the pulser voltage to acoustic energy during the transmit portion of the ultrasound acquisition cycle. The transducer elements convert the acoustic echo to voltage in the receive portion of the acquisition cycle. The system transducers have 64 or more elements. The voltage developed on the transducer elements is sensed by the acquisition subsystem.

3.1.2 Acquisition Subsystem

The acquisition subsystem consists of a beamformer and an interface to the transducer. The beamformer times the transmit pulses to focus the acoustic beam. The beamformer amplifies the low-level echo signal and times the receive information to focus the receive information.

3.1.3 Processing Subsystem

The processing subsystem interfaces with the beamformer and performs high-speed processing. The processing subsystem demodulates, filters, detects, and compresses the signal supplied by the beamformer; it then supplies this data to the display subsystem.

3.1.4 Display Subsystem

The display subsystem converts the detected ultrasound data into picture elements (pixels). The software user interface graphics are combined with the ultrasound information and converted to a video stream. The external video ports support NTSC and PAL format.

3.1.5 Control Subsystem

The control subsystem consists of the central processing unit, program and video memory, permanent image storage and retrieval memory, and a connection to the user interface keys. The control software includes the acoustic power and intensity software power group monitors, and a beamformer monitor. This software guarantees a level of patient safety by ensuring the system is operating within acoustic power and intensity limits.

3.1.6 User Interface Subsystem

The user interface subsystem comprises the software user interface and the form factor. The software user interface is the interaction between the user and the screen layout components. The form factor is the type of physical buttons, location, and grouping of the buttons and the device size, shape, and weight. Dedicated controls are for high usage activities and are grouped according to user workflow.

3.1.7 Power Subsystem

The power subsystem provides the system power and protects the hardware from destructive or unsafe conditions by detecting failures in the system through hardware and software monitors. Detection of a fault disables the pulser supply, and signals an error to the control subsystem. The power subsystem includes the battery pack and the battery charging electronics.

3.2 Components

The SonoSite system components include a hand-carried ultrasound system, a transducer, and a power adapter. The hand-carried ultrasound system contains the system electronics, display, control panel, and battery pack. The transducer contains the transducer, cable, and memory. The power adapter conditions the external power so it can be used to power the system and charge the batteries while in the system.

3.3 Controls

Figure 3.2 shows the SonoSite system controls. The numbers correspond to the control names and functional descriptions in Table 3.1.

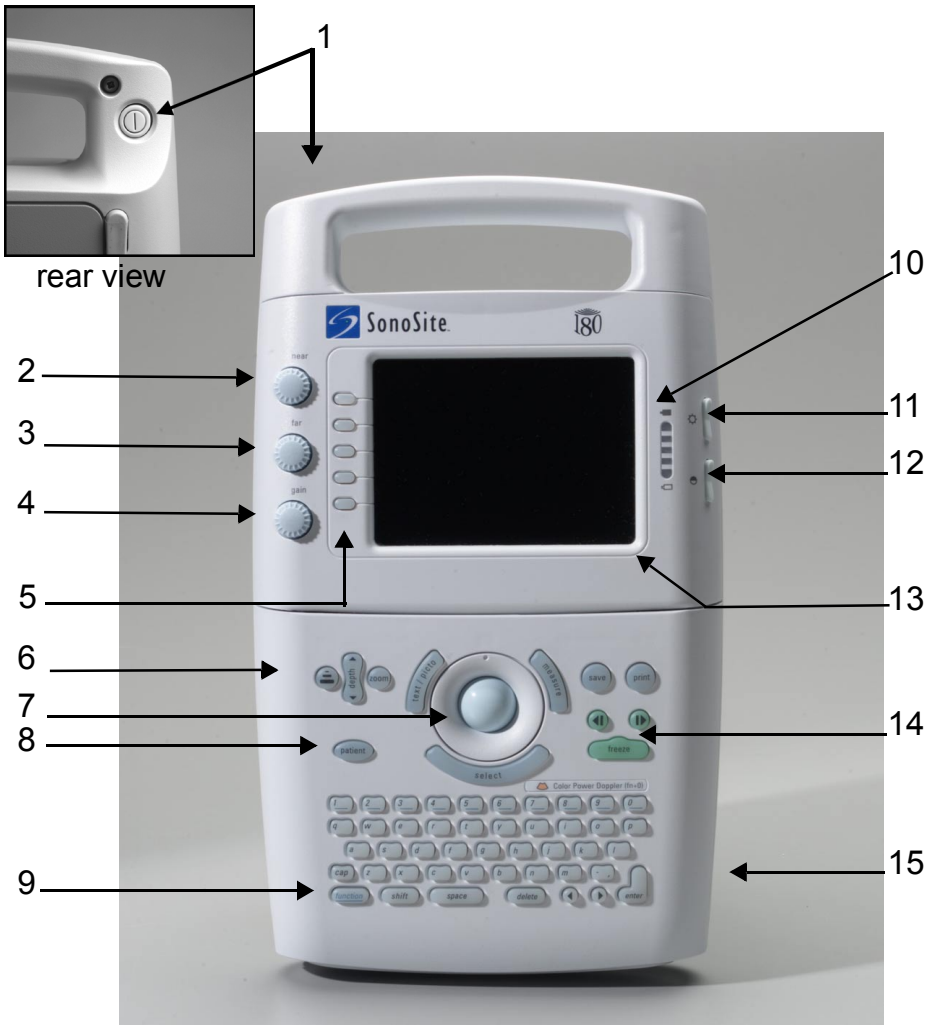


Figure 3.2 SonoSite Ultrasound System Controls

Table 3.1 SonoSite Ultrasound System Controls

NUMBER	CONTROLS	DESCRIPTION
1	power switch (located on the rear of the system handle)	Turns power on and/or off.
2	near	Affects gain of shallow echoes for 2D.
3	far	Affects gain of deeper echoes for 2D.
4	gain	Affects overall gain in 2D and CPD gain in CPD.
5	menu controls	Press patient to access system menus.
6	optimize, depth, and zoom	Provides an image optimization menu; changes the display depth; increases the image size to 2x.
7	trackball	Moves objects on the image display.
8	patient	Displays the system menus.
9	function key (f1 through f6)	Assigns text for quick labeling of images.
10	battery charge indicators	All LEDs lit indicate a fully-charged battery.
11	LCD (liquid crystal display) monitor brightness control	Controls LCD brightness.
12	LCD monitor contrast control	Controls LCD contrast.
13	LCD monitor	Adjustable liquid crystal display monitor.
14	cine arrows and freeze control	Press to move either way through the cine series of images.
15	battery release	Press to release the battery.

3.4 Accessories

This section describes the following optional SonoSite system accessories that may be included with the system.

3.4.1 SiteStand Mobile Docking Station

WARNING:

- To avoid the risk of electrical shock, use commercial grade peripherals recommended by SonoSite on battery power only. Do not connect these products to the AC mains IEC power receptacles on the SiteStand when using the system to scan or diagnose a patient/subject. Contact SonoSite or your local representative for a listing of the commercial grade peripherals available from or recommended by SonoSite.

Do not use the system if it exhibits artifacts on the LCD screen, either within the clinical image. Artifacts are indicative of hardware and/or software errors that must be corrected before use.

The SiteStand mobile docking station (SiteStand) (Figure 3.3) provides power, video, print, and image transfer capabilities for the system. It holds the SonoSite system, transducers, a printer, and accessories. It also provides the following connections: three video ports, an RS-232C port, a printer control port, and two AC

mains IEC power receptacles. You can tilt the system and adjust the height of the system when it is in the SiteStand.

3.4.1.1 SiteLink Image Management Software

SiteLink Image Management (SiteLink) software is available to use with your system, a SiteStand, and a connected PC. SiteLink allows you to transfer images from the SonoSite system to a host PC. For more information, refer to the *SiteLink Image Manager User Guide*, which is available in PDF format on the SiteLink CD-ROM.

3.4.1.2 IrfanView Software

IrfanView software is provided with SiteLink. IrfanView allows you to view and manipulate images that have been transferred to the PC. For more information about IrfanView, refer to the help files that are included in the software.

3.4.2 SiteStand Display

The SiteStand may include an optional SiteStand display (Figure 3.3), which is a Digital View Series DV-3000 Colour LCD Rugged Monitor (10.4-in. / 26.4 cm). It includes a cable for a VGA connection and a power supply (100–240V AC input, 12V DC output).

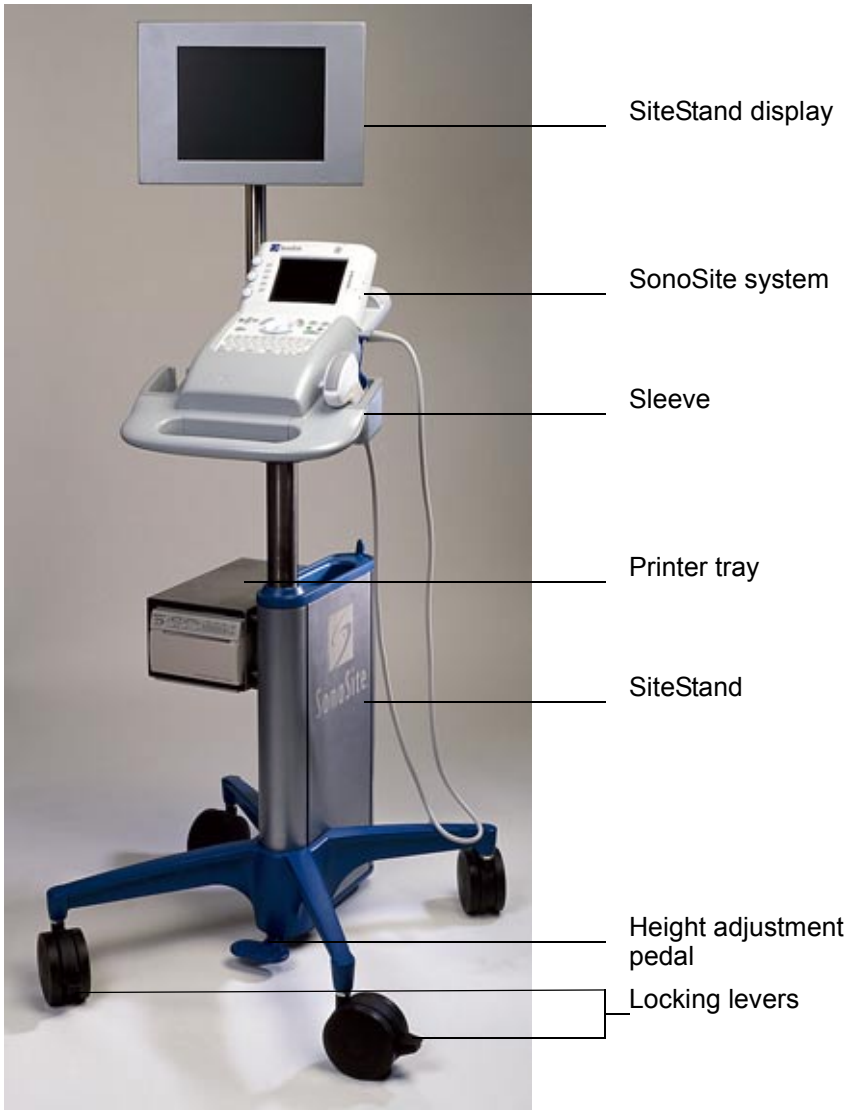


Figure 3.3 SiteStand with Display

3.4.3 SiteCharge Dual Battery Charger

The SiteCharge dual battery charger (Figure 3.4) can charge two lithium-ion batteries simultaneously. It indicates the following states for each battery: charging state, charging fault condition, and charged state. It charges a completely discharged six-cell battery in approximately 3.5 hours. The ambient temperature of the SiteCharge dual battery charger should be between 32° to 104° F (0° to 40° C) for charging to be successful. Table 3.2 describes the LEDs and their corresponding system states.

Figure 3.4 SiteCharge Dual Battery Charger with Batteries and Power Adapter

Table 3.2 Charger LED Colors and Battery States

CHARGER LED COLOR	BATTERY STATE
Yellow	The battery is charging.
Green	The battery is charged.
Flashing yellow	The charger has detected a system fault.

If the charger detects a system fault, the yellow LED on the charger will light. Reseat the battery to clear the fault. If the fault continues, replace the battery pack.

3.4.4 SitePack Protective Carry Pack

The SitePack protective carry pack can transport the SonoSite system, three transducers, accessories, and supplies.

3.4.5 Battery Pack

CAUTIONS:

- See protecting against electrostatic discharge in **Chapter 2, *Safety,*** on page 5.

Use only the specified SonoSite battery pack.

The system can be powered from either a battery pack or external power.

The system is powered by a rechargeable, six-cell, 11.1 Vdc, 3.0 amp-hours, lithium-ion battery (Figure 3.4). A fully-charged battery has a run time of 1.5 to 4 hours, depending upon operating conditions. The battery pack case is made of injection molded plastic. When in use, it is inserted into the system. The battery pack has no user-serviceable parts. The operating life of the battery ranges from 1-2 years, depending on how you use the system. Table 3.3 contains battery operating specifications.

Table 3.3 Battery Pack Operation Specifications

BATTERY PACK OPERATION PARAMETER	SPECIFICATION
Operation time during use model	2 hours @ 77° F (25° C)
Operation time during power off (leakage and self discharge)	14 days @ 77° F (25° C)
Number of charge discharge cycles (100% depth of discharge)	500 @ 77° F (25° C)

3.4.5.1 Battery Charge Indicators

The battery charge indicators, which consist of light-emitting diodes (LEDs) on the system, indicate the current battery level.

- All LEDs lit mean the system battery is fully charged.
- Some LEDs lit mean the system battery is partially charged.

Table 3.4 contains the charging requirements for the system.

Table 3.4 System Charging Requirements

SYSTEM CHARGING PARAMETER	SPECIFICATION
Charge time to 80% capacity (internal charger) with the system off	3 hours @ 77° F (25° C)
Charge time to 80% capacity (internal charger) with the system on	12 hours @ 77° F (25° C)

3.4.6 External Power

The external power connection provides external power to the system via the power adapter. External power charges the battery pack and powers the system in low battery conditions.

3.4.6.1 External System Connections

Figure 3.5 shows the following external system connections:

- An AC line voltage receptacle (1) connects the system to an power adapter.
- A remote control receptacle (2) connects the system to a recommended printer.
- A video receptacle (3) provides a composite video signal for a recommended VCR, video printer, or monitor.

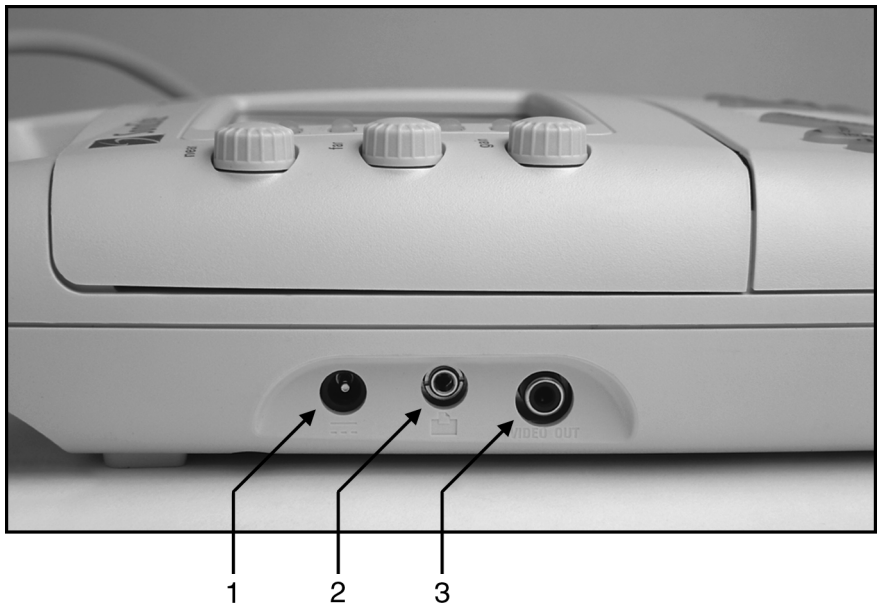


Figure 3.5 External System Connections

3.4.7 Power Adapter

CAUTION:

▶ Use only the specified SonoSite power adapter.

The SonoSite system can be powered by a universal power adapter (50–60 Hz, 100–240 VAC). When the system is plugged into a wall outlet, the battery pack simultaneously recharges. Recharging a battery, which is not fully discharged, will not decrease battery life. The ambient temperature shall be between 32° and 104° F (0° and 40° C) to successfully charge a battery. To maintain battery charge, attach the power adapter to the system whenever the system is not in use.

Power Cord

Table 3.5 provides power cord specifications.

Table 3.5 Power Cord Specifications

CONFIGU-RATION	LENGTH	RATING	MALE PLUG	FEMALE CONNEC-TOR	APPRO-VALS	MARKING
100-120 VAC/ 60 Hz	9 ft. 10 in.	250 VAC	MA 5-15P Hospital grade, grounding type molded on	CEE-22, molded on	UL, CSA	Manufac-turer, Agency Approvals
230 VAC / 50 Hz / PAL 230 VAC / 60 Hz	3 m	250 VAC	CEE-7/VII grounding type with 4.8 mm pins molded on	CEE-22, molded on	EU	Manufac-turer, Agency Approvals

3.4.8 Cables

3.4.8.1 Video

This video cable (10 ft / 3.1 m) connects the system to the external monitor or video printer. It has RCA-to-BNC connectors.

This video cable (10 ft / 3.1 m) connects the system to the Sony GV-900 Digital Video Recorder. It has RCA-to-RCA connectors.

This video cable (6 ft /1.8 m) connects the system to the Casio EV-660 Handheld Monitor. It has RCA-to-Stereo connectors.

3.4.8.2 Printer Control

The printer control cable (10 ft / 3.1 m) connects the system to the video printer. It has mini-jack to mini-jack connectors.

3.4.8.3 AC Power Extension

The AC power extension cable (1 ft / 0.3 m) connects the power supply to the SiteStand.

3.4.9 Video

The system has one internal video path and one external video port. The internal video is generated for input to a display. The external video is composite interlaced video.

Any image that displays on the system display module can be recorded on a VCR, printed, or displayed on an external monitor. The external video may be connected to a variety of devices, such as a monitor, video printer, or VCR. The video output is either NTSC or PAL format, which is user-configurable in system setups.

3.4.9.1 Video Port Cable

The video cable has a 75 ohm impedance and is shielded. Table 3.6 provides video cable signal specifications.

Table 3.6 Video Cable Signal

CONNECTOR PIN	SIGNAL
Center conductor	Video
Shield	Signal ground

3.5 System Specifications

This section provides specifications for the SonoSite ultrasound system.

3.5.1 Physical Dimensions

Height: 13.3 in. (33.8 cm)

Width: 7.6 in. (19.3 cm)

Depth: 2.5 in. (6.35 cm)

Weight: 5.4 lbs (2.46 kg) with the C60/5-2 MHz transducer connected

3.5.2 Monitor

Height: 4.3 in. (10.9 cm)

Width: 3.1 in. (7.9 cm)

Diagonal: 5 in. (12.7 cm)

Brightness control

Contrast control

3.5.3 Transducers

C60/5-2 MHz 60-mm, curved array

C15/4-2 MHz 15-mm, micro-curved array

ICT/7-4 MHz 11-mm, intracavitary

L38/10-5 MHz 38-mm, linear array

3.5.4 Imaging Modes

2D Imaging (256 gray shades)

CPD Imaging (64 colors)

PowerMap DCPD Imaging (64 colors)

3.5.5 Image Storage

Up to 120 images (depending on the configuration of the system)

Cine review

3.5.6 Temperature and Humidity Limits

3.5.6.1 System Operating

- 50–104° F (10–40° C), 15–95% R.H.
- 700-1060hPa (0.7 ATM to 1.05 ATM)

3.5.6.2 System Shipping/Storage

- -31–149° F (-35–65° C), 15–95% R.H.
- 500-1060hPa (0.5ATM to 1.05 ATM)

3.5.6.3 Battery Operating

- 50–104° F (10–40° C), 15–95% R.H.

3.5.6.4 Battery Shipping/Storage

- -4–140° F (-20–60° C), 0–95% R.H.

3.5.6.5 Transducers Operating

- 50–104° F (10–40° C), 15–95% R.H.

3.5.6.6 Transducers Shipping/Storage

- -31–149° F (-35–65° C), 15–95% R.H

3.5.7 Electrical

- System optional: 100-120/220-240 Vac, 50/60 Hz input, 16.0 Vdc output power adapter
- SiteCharge dual battery charger input voltage: 16.0 Vdc, 2.8 A
- SiteCharge dual battery charger output voltage: 12.6 Vdc, 3.0 A (2x)
- AC power adapter input: 100-120/220-240 Vac, 50/60 Hz, 1.0-0.50 A
- AC power adapter output: + 16.0 Vdc, 2.8 A
- SiteStand input: 100-120/220-240 Vac, 50/60 Hz, 1.0-0.50 A
- SiteStand outputs: + 16.0 Vdc, 2.8 A. and 100-120/220-240 Vac, 50/60 Hz, 1.0-0.50 A (2x)
- SiteStand display input: +12VDC, 2.75 A

3.6 Battery

- 6-cell, 11.1 Vdc, 3.0 amp-hours, rechargeable, lithium-ion battery pack
- Run time: 1.5 to 4 hours, depending upon operating conditions

3.7 Safety Requirements

3.7.1 Meets Electromechanical Safety Standards

EN 60601-1:1997, European Norm, Medical Electrical Equipment-Part 1. General Requirements for Safety.

EN 60601-1-1:1993, European Norm, Medical Electrical Equipment–Part 1.General Requirements for Safety–Section 1-1. Collateral Standard. Safety Requirements for Medical Electrical Systems.

EN 60601-1-2:1998, European Norm, Medical Electrical Equipment. General Requirements for Safety-Collateral Standard. Electromagnetic Compatibility. Requirements and Tests.

C22.2, No. 601.1:1998, Canadian Standards Association, Medical Electrical Equipment-Part 1. General Requirements for Safety.

CEI/IEC 61157:1992, International Electrotechnical Commission, Requirements for the Declaration of the Acoustic Output of Medical Diagnostic Ultrasonic Equipment

UL 2601-1:1999, Underwriters Laboratories, Medical Electrical Equipment-Part 1: General Requirements for Safety.

3.7.2 Meets EMC/EMI Standards

IEC 61000-4-2:1999, International Electrotechnical Committee, Electromagnetic Compatibility (EMC)-Part 4. Testing and Measurement Techniques-Section 4.2: Electrostatic Discharge/Immunity Test-Basic EMC Publication

IEC 61000-4-3:1997, International Electrotechnical Committee, Electromagnetic Compatibility (EMC)-Part 4. Testing and Measurement Techniques-Section 3: Radiated Radio-Frequency, Electromagnetic Field Immunity Test.

IEC 61000-4-4:1995, International Electrotechnical Committee, Electromagnetic Compatibility (EMC)-Part 4. Testing and Measurement Techniques-Section 4, Electrical Fast Transient/Burst Immunity Test-Basic EMC Publication.

IEC 61000-4-5:1999, International Electrotechnical Committee, Electromagnetic Compatibility (EMC)-Part 4. Testing and Measurement Techniques-Section 5, Surge Immunity Test.

CISPR11:97, International Electrotechnical Commission, International Special Committee on Radio Interference. Industrial, Scientific, and Medical (ISM) Radio-Frequency Equipment Electromagnetic Disturbance Characteristics-Limits and Methods of Measurement.

3.7.3 Meets Airborne Equipment Standards

RTCA/DO160D:1997, Radio Technical Commission for Aeronautics, Environmental Conditions and Test Procedures for Airborne Equipment, Section 21.0 Emission of Radio Frequency Energy, Category B.

CHAPTER 4

Setup and Operation

WARNING:

- CRITICAL TEST FUNCTION - A failure of the system functional tests performed in this procedure could adversely affect safety or effectiveness of the system.

4.1 Connecting and Removing Transducers

The system is supplied with one or more transducers. Only one transducer can be connected to the system at a time.

WARNING:

- The transducer connector can become hot during operation. This is normal. Operate the system in the SiteStand or on a flat, hard surface to allow air flow past the connector.

CAUTION:

- The electrical contacts inside the system transducer receptacle may be damaged by foreign material or by rough handling. Do not touch the electrical contacts. Keep foreign material out of the receptacle. Keep a transducer connected to the system whenever possible.

To connect the transducer:

1. On the transducer connector, pull the lever up and rotate it clockwise until it snaps to a stop (Figure 4.1). The lever should be easy to move. Do not force the lever.
2. Align the transducer connector with the transducer receptacle on the rear of the system and insert it by pushing the transducer connector into the transducer receptacle. The transducer connector should be easy to insert. Do not force the transducer connector.
3. Turn the lever counterclockwise until it snaps to a stop.

4. Press the lever down until it snaps into place, securing the transducer connector to the system.

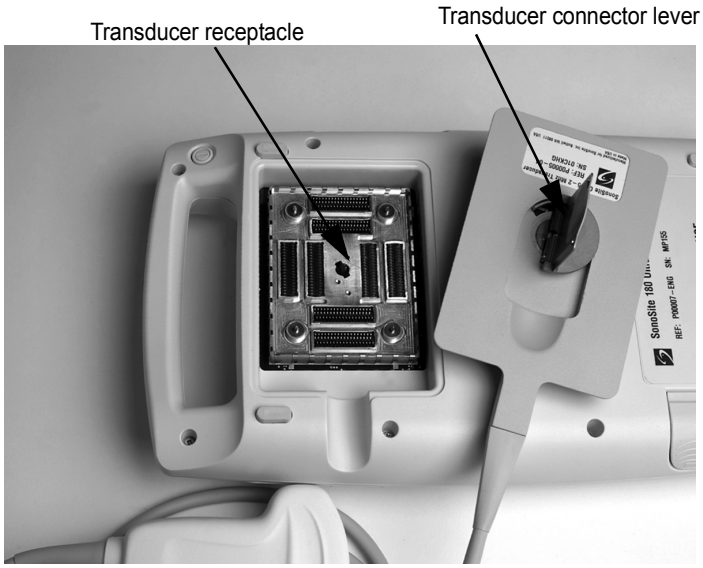


Figure 4.1 Connecting the Transducer

To remove the transducer:

1. On the transducer connector, pull the lever up and rotate it clockwise until it snaps to a stop (Figure 4.1).
2. Carefully pull the transducer connector away from the system.

4.2 Removing and Installing the Battery

WARNING:

- If you are holding the system, when you remove the battery, place your hand beneath the battery. If it falls to the floor, it could be damaged, or cause personal injury.

If the battery is being installed for the first time, it will need to be charged.

To remove the battery:

1. Press and hold the **power** switch for one second to turn off the system.
2. Locate the battery compartment at the bottom of the system.
3. If you are holding the system, place your hand beneath the battery to ensure that it does not fall out upon release.
4. Press the battery release button (lower, right side) to release the battery.

To install the battery:

1. Locate the battery compartment at the bottom of the system (Figure 4.2).
2. Install a new battery (label side up) into the battery compartment by pushing it into the compartment until it clicks into place. (Do not force the battery into the compartment, check the battery orientation if the battery is difficult to install.) Ensure that both sides of the battery are fully connected and that the battery release button is not pressed.

Figure 4.2 Inserting the Battery

4.3 Turning the System On and Off

When turning power on or off, you must press and hold the power switch for approximately one second before the system responds. This feature prevents battery discharge, resulting from accidentally turning the system on. It also prevents accidentally turning the system off during an exam.

The first time you turn on the system, set the date and time. *See "Setting the Date and Time" on page 40.*

CAUTION:

- Do not use the system if an error message appears on the image display. Note the error code. Call SonoSite technical support or contact your local representative. When an error code occurs, turn off the system by pressing and holding the power switch until the system powers down.

To turn on power:

1. Locate the **power** switch on the back of the left side of the system handle. See Figure 3.2, *SonoSite Ultrasound System Controls,* on page 14.
2. Press and hold the **power** switch until the system beeps or until you see the image display.
3. Release the **power** switch.

To turn off power:

1. Press and hold the **power** switch.

   You will hear the system emit two sets of "high-low" beeps. The system powers off after the second set of beeps.
2. Release the **power** switch.

To wake up the system:

- The system has a sleep delay, which is invoked based on the **sleep delay** system setup. When the battery charge indicators are blinking, but the other system lighting is off, press any system control to wake up the system.

4.4 Using AC Power

The battery charges while using the system on AC power. If the system is off and connected to AC power, a fully discharged battery will charge in about 3 hours.

To use AC power:

1. Connect the line cord to the AC power adapter.
2. Connect the line cord to a hospital-grade, electrical outlet.
3. Connect the AC power adapter to the system AC line voltage receptacle on the upper left side of the system (Figure 4.3).

Note: You must wait approximately 10 seconds after connecting to AC power before turning on the power switch.

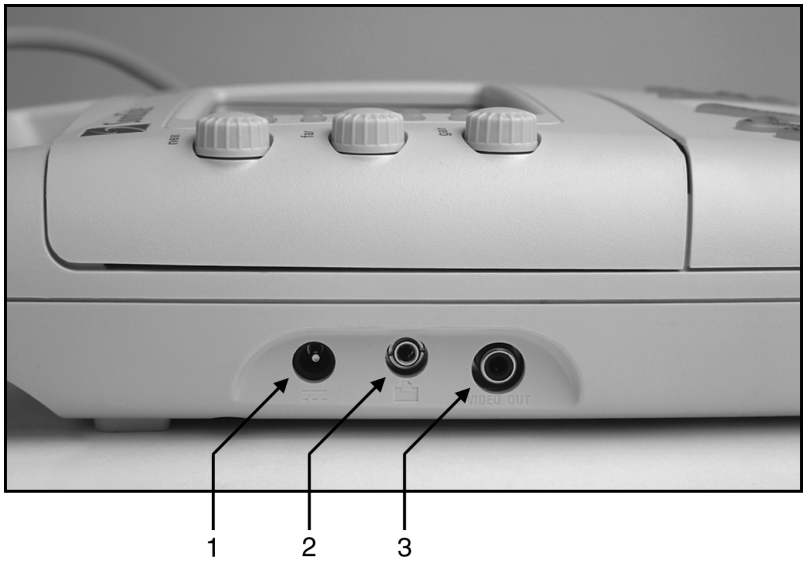


Figure 4.3 System Connections

Table 4.1 lists the SonoSite system connections.

Table 4.1 System Connections

NUMBER	FEATURE
1	AC line voltage receptacle.
2	Remote control receptacle for an approved printer.
3	Video receptacle for an approved VCR, printer, or external video monitor.

4.5 Upgrading the System Software

Transducers that you receive from SonoSite may contain either required or optional upgrades to the system software that resides on your SonoSite system. Whenever you connect a transducer to a SonoSite system, the system communicates with a transducer to determine if the transducer contains software that would upgrade the system.

***CAUTION*:**

- Initiating any upgrade of the system software erases any images stored on your system. Do not upgrade the system software until you have determined that any stored images are no longer needed.

To upgrade the system software:

1. When you first connect a transducer with new software and turn the system on, the following message displays:
   Do you want to upgrade the system software?

For required upgrades:

You must either perform the software upgrade or replace the transducer with one that is compatible with the software currently installed on your system. Do one of the following:

- Select **no** (disconnect transducer) to reject the system software upgrade.
- Select **yes** (up to 20 minutes) to accept the system software upgrade and go to step 2.

For optional upgrades:

You may either install the new software or continue to use the existing software. SonoSite recommends that you install these optional upgrades soon after receiving them. Do one of the following:

- Select **no** (continue) to use the system without upgrading.
- Select **yes** (up to 20 minutes) to accept the upgrade and go to step 2.

2. When you have accepted the upgrade, the system loads the new software and displays the following message:
   Upgrade in progress (20 minutes total).

   Note: The system upgrade can take up to 20 minutes; however, many software upgrades will complete successfully in less time.

To cancel the upgrade in progress, select **cancel.**

If this is a required upgrade:

- The existing software remains installed.
- The system displays the following message:
  Incompatible transducer, upgrade the system software.

If this is an optional upgrade:

- The existing software remains installed.
- The system will go to live scan.

3. When the system has loaded the new software, the following message displays:
   Successful upgrade.

   If the software upgrade is unsuccessful, the system displays an error code and you must contact SonoSite technical support. For U.S. customers, call 1-877-657-8118. For international customers, call 1-425-951-1330 or contact your local representative.

4. Select **reboot** to restart your system.

   During the restart, the initial system screen will show two progress indicator bars. These progress indicator bars are present while the system is replacing its operating software and will disappear when the process is completed.

When the operating software has been replaced, the system will present you with the license update screen so that you may license the software. At this point, the software upgrade process is complete, but the system software is not yet licensed. The following section explains how to license your software.

4.6 Obtaining A License Key

A license key is required to update your SonoSite system. To obtain a license key, do one of the following:

USA/Canada Customers

- Technical support: **1-877-657-8118**
- Technical support fax and email: **1-425-951-6700**; **service@sonosite.com**
- SonoSite website: www.sonosite.com

International Customers

- Call your local representative or **1-425-951-1330**.

To receive a license key, you will need to provide the following information, which is displayed on the system information screen of your system (except for the name of the person installing the upgrade and the system serial number):

- Name of the person installing the upgrade
- System serial number (SN) (located on the back of your system)
- License Update number
- ARM Ver: (version)
- PCBA Serial No: (number)

See Section 4.6.1.1, Displaying the System Information Screen, on page 35. If the system is on and the grace period expires, the license information screen can be displayed from the system information screen.

4.6.1 Installing A License Key

When you have obtained a license key for the software, you must enter it into the system. Once a valid license key has been entered, the system remains licensed until the next time the system software is upgraded.

1. Turn on the system. If the software is not yet licensed, the license update screen displays (Figure 4.4).

   The license update screen displays the following information: the License Update number, the ARM Ver (version), the PCBA Serial No. (number), the SonoSite web site address and telephone number, the license number, the

register later or done button, and the grace period (time remaining) on your system.

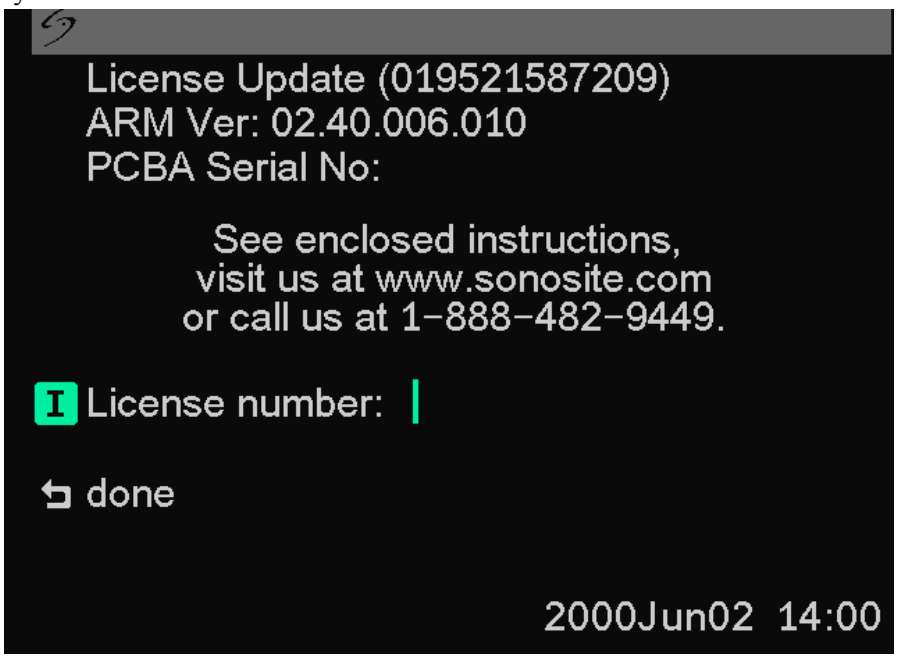


Figure 4.4 License Update Screen

Note: The software versions on your system may vary based on your upgrade and configuration.

2. Enter your license key in the license number field.

- If the license key that you entered is recognized by the system as being valid for your system and the software you installed, a done button displays. Select **done** to install the license key and license your software.
- If the license key that you entered is not recognized by the system, the register later button remains on the screen as long as the defined grace period has not expired.
- If the grace period has expired, the menu item will indicate this by showing zero hours remaining in the grace period. At this point, you must then enter a valid license key before you can use the system with this or any other transducer.

Note: If you have entered a valid license key and you cannot complete the licensing procedure, verify that the license key has been entered correctly.

The license key should be exactly 12 digits (for example, 123348990552) with no other characters or punctuation.

If after confirming correct entry of the license key, you are still unable to license your system; call SonoSite technical support. U.S. customers call 1-877-657-8118. *International customers call 1-425-951-1330 or contact your local representative.*

- If the system is on and the grace period expires, the license update screen must be displayed from the system information screen.

4.6.1.1 Displaying the System Information Screen

To display the system information screen:

1. Press and release **function**.
2. Press and release **i**. The system information screen displays (Figure 4.5).

   The system information screen displays the following information: the Boot/PIC Vers (version), the ARM Ver (version), the PCBA Serial No (number), the Product Name, the Status, the CPLD 1, 2, 3 Ver, CPLD SH Ver (version), SHDB Ver (scanhead database version), and the Sh Serial No (scanhead serial number).

   Note: The software versions on your system may vary based on your upgrade and configuration.

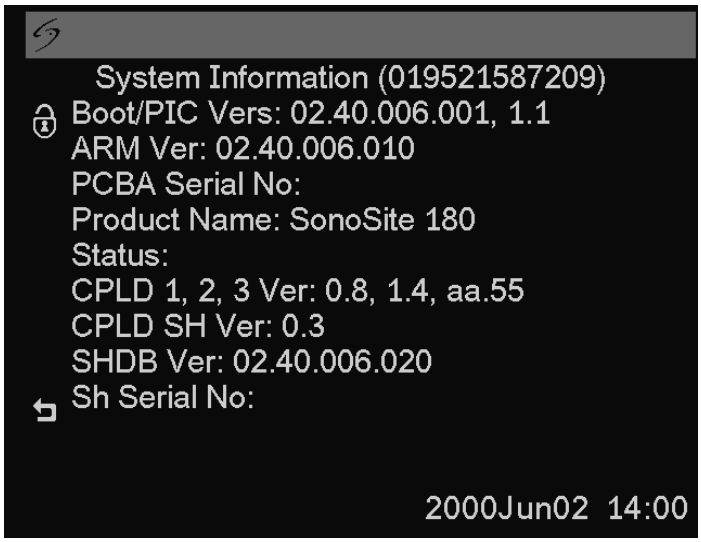


Figure 4.5 System Information Screen

To display the license update screen:

On the system information screen, select the **padlock icon** (upper left corner of the screen) to display the license update screen. See Section 4.6.1, *Installing A License Key,* on page 33.

4.7 Checking and Charging the Battery

Note: Disconnect the system from AC power prior to checking the battery charge.

To check the battery:

Five light-emitting diodes (LEDs) on the right side of the system monitor allow you to check the battery condition. If all LEDs are lit, the battery is fully charged. A solid dark gray battery icon in the lower right portion of the system display indicates a low battery. A solid white battery icon indicates approximately 10 minutes of battery life remaining. A flashing white battery icon indicates approximately 5 minutes of battery life remaining.

The system will operate on a fully-charged battery for 1.5 to 4 hours, depending upon use. Ensure the battery is charged at all times to provide the longest possible battery operation. You can set the **sleep delay** and **power delay** in system setup to prolong battery life. See Section 4.9, *Using System Setup,* on page 39.

When the system is not likely to be used for some time, to prevent total battery discharge, remove the battery from the system.

To charge the battery:

CAUTION:

- Charge batteries only when the ambient temperature is between 32° and 104° F (0° and 40° C).

1. Connect the line cord of the power adapter to a hospital-grade electrical outlet.
2. Connect the AC power adapter to the power receptacle on the system (1) (Figure 4.6 and Table 4.2).
3. Disconnect the system from AC power.

   Note: It takes about three hours to charge a battery when the system is off.
4. Turn the system on to check the battery charge.

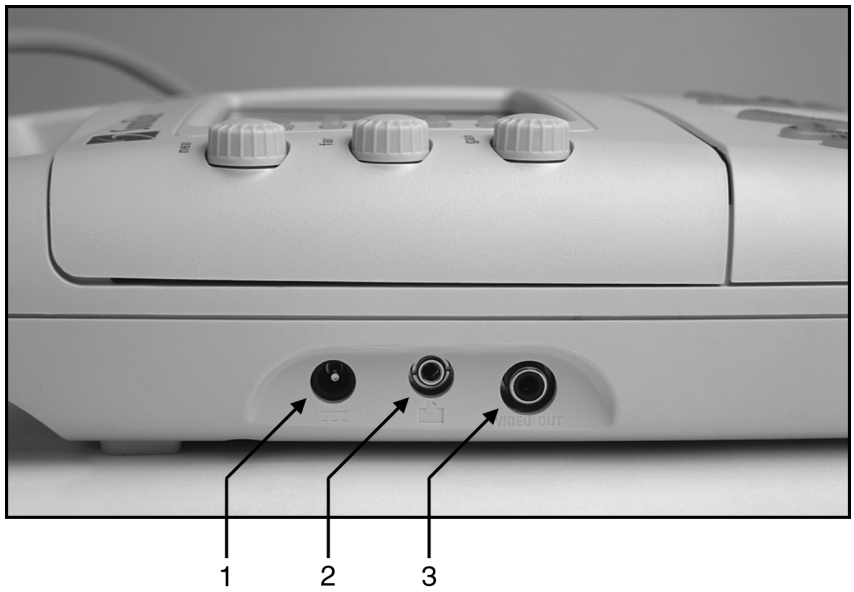


Figure 4.6 System Connections

Table 4.2 System Connections

Number	Feature
1	DC line voltage receptacle.
2	Remote control receptacle for an approved printer.
3	Video receptacle for an approved VCR, printer, or external video monitor.

4.8 Using the SiteCharge Dual Battery Charger

To use the SiteCharge dual battery charger:

1. Connect the power adapter to the SiteCharge dual battery charger (Figure 4.7).
2. Connect the AC line cord to a power receptacle. When the blue SonoSite logo on the front of the SiteCharge dual battery charger lights, it indicates that the power is on.
3. Insert one or two batteries into the SiteCharge dual battery charger (the batteries only fit one way). Refer to Table 4.3 for SiteCharge dual battery charger information.
   Note: When the battery reaches full charge, the green LED will be lit.

Figure 4.7 SiteCharge Dual Batter Charger

Table 4.3 SiteCharge Dual Battery Charger LEDs

LIGHT COLOR (NEXT TO BATTERY)	STATUS	INDICATES	SOLUTION
Yellow	Lit	The battery is charging. It may take up to 60 seconds for the yellow light to come on depending on the discharge state of the battery.	
Yellow	Lit	When lit for more than six hours, charging will be suspended.	Remove and reinsert the same battery. If the battery is not fully charged within another six hours, call SonoSite or your local representative.
Yellow	Flashing	The battery is not properly installed. The battery or the SiteCharge dual battery charger is defective.	Re-install the battery into the SiteCharge dual battery charger. If the battery is properly installed and the yellow light still flashes, call SonoSite or your local representative.
Green	Lit	The battery is fully charged and is ready for use. (The SiteCharge dual battery charger can charge one or two batteries in less than four and a half hours, depending on the discharge state of the battery.)	
Yellow/Green	Off	Battery is defective.	Call SonoSite technical support.

Note: If the ambient temperature is below 32°F (0°C) or above 113°F (45°C), the charger may suspend charging due to an over/under temperature condition and the green light will be lit. Battery operating time may be reduced.

4.9 Using System Setup

***CAUTION*:**

- If the video format on the system is changed, you will need to turn the system power off and then on. If you do not do this, artifacts may appear in your images.

System setup is used to customize the system. It is available by pressing **patient** and selecting **system setup**. System setup includes settings for image orientation (four selections), the caliper line that connects the measurement calipers (on/off), thermal index selection (TIs TIb), and pictographs (on/off). System setup also includes screen information settings that allow you to show or hide the following items: the optimize icon, the time, the memory icon, and the patient name. You can also set the audible beep, sleep delay, power delay, and the date/time. Additionally, system setup includes the video format, printer, calcs authors, and function key assignments. You can resume imaging from any system setup function by pressing **patient**.

Perform the following procedures to become familiar with using system setup, then use these basic operations to set the range of setups required for your uses.

4.9.1 Setting the Date and Time

WARNING:

- An accurate date and time are critical for accurate obstetrics calculations. Verify that the date and time are accurate before each use of the system. The system does not automatically adjust for daylight savings time changes.

To set the date and time:

1. Press **patient**. A menu appears on which **system setup** is listed.
2. Select **system setup**. A menu appears on which is listed **audio, battery, date/time**.
3. Select **audio, battery, date/time.**
4. Select **date/time**. A cursor appears at the left side of the date/time display.
5. Type in the current date (year, month, day) and time in the 24-hour format (hours, minutes). If you make a mistake, you can use the **arrow** keys between the **delete** and **enter** keys to move the cursor.
6. Press **patient** to resume imaging.

4.9.2 Setting the Sleep Delay

To set sleep delay:

1. Repeat steps 1 through 3 in *Section 4.9.1*.
2. Select **sleep delay (min)**.
3. Press **sleep delay (min)** again to select **3**, **5**, or **10**.
4. Press **patient** to resume imaging.

4.9.3 Setting the Power Delay

To set power delay:

1. Repeat steps 1 through 3 in *Section 4.9.1*.
2. Select **power delay (min)**.
3. Press **power delay (min)** again to select **off**, **15**, or **30**.
4. Press **patient** to resume imaging.

4.9.4 Setting the Audible Beep

To turn on or off the audible beep:

1. Repeat steps 1 through 3 in *Section 4.9.1*.
2. Select **audible beep**.
3. Press **audible beep** again to select **on** or **off**.
4. Press **patient** to resume imaging.

4.9.5 Setting Up A Recommended Printer

CAUTION:

- Use only peripherals recommended by SonoSite with the system. The system can be damaged by connecting a peripheral not recommended by SonoSite.

To set up a recommended printer:

To use the system print controls, **print** and **print all images**, the remote control must be connected.

1. Connect a recommended printer to the system using the recommended printer control cable. The receptacles are on the left side of the system. There are two connections required: **VIDEO OUT** (3 in Figure 4.6) and **remote** icon (2 in Figure 4.6).
2. Turn on the printer. (Refer to the printer manufacturer's instructions for specific printer information.)
3. Press **patient**. A menu appears on which is listed **system setup**.
4. Select **system setup**. A menu appears on which is listed **video**, **printer**, **calcs**, **f keys**.
5. Select **video, printer, calcs, f keys**.
6. Select **printer** to select the type of printer connected to the system. (Only the types of printers appearing as settings are recommended for use with the system.) The printer is ready to print.
7. Press **patient** to resume imaging.

4.9.6 Setting Up A Recommended VCR

To set up a recommended VCR:

1. Connect a recommended VCR to the system using the recommended video cable. The receptacle is on the left side of the system. There is one connection required: **VIDEO OUT** (3 in Figure 4.6).
2. Turn on the VCR. (Refer to the VCR manufacturer's instructions for specific VCR information.)
3. Press **patient**. A menu appears on which is listed **system setup**.

4. Select **system setup**. A menu appears on which is listed **video**, **printer**, **calcs**, **f keys**.
5. Select **video**, **printer**, **calcs**, **f keys**.
6. Select the appropriate video format: **NTSC** or **PAL**.
7. Press **patient** to resume imaging.
8. Use the controls on the VCR to record the image display. A separate video monitor, connected to the VCR, is required for playing the recording.

4.9.7 Setting Up A Recommended Video Monitor (External)

To set up a recommended video monitor (external):

1. Connect a recommended video monitor to the system using the recommended video cable. The receptacle is on the left side of the system. There is one connection required: **VIDEO OUT** (3 in Figure 4.6).
2. Turn on the video monitor. (Refer to the video monitor manufacturer's instructions for specific information.)

4.9.8 Setting Up Function Key Assignments

To set up function key assignments:

Function keys 1 through 6 can be assigned text for quick and easy labeling of images.

1. Press **patient**. A menu appears on which is listed **system setup**.
2. Select **system setup**. A menu appears on which is listed **video, printer, calcs, f keys**.
3. Select **video, printer, calcs, f keys**.
4. Select **function key assignment**. A menu appears which lists function keys, **f1** through **f6**.
5. The data entry cursor appears next to **f1**.
6. Type in your text. Use the **arrow** and **space** keys to correct mistakes.
7. Press **enter** to move to the next field. Continue to assign text to the remaining function keys, as desired.
8. Select a new exam type to assign function key text and repeat the steps above, or select **done** when finished. Refer to the *SonoSite 180 or SonoHeart User Guide* for how to use the assigned function keys.

4.9.9 Changing All System Setups to the Default Settings

WARNING:

- An accurate date and time are critical for accurate obstetrics calculations. Verify that the date and time are accurate before each use of the system.

To change all system setups to the default settings:

1. Turn the system off.
2. Connect the system to AC power, see *Section 4.4, Using AC Power,* on page 30.
3. Simultaneously press and release 1 and the power switch. The system beeps several times and then the image display appears with all default settings.
4. Reset the system settings, see *Section 4.9, Using System Setup,* on page 39.

CHAPTER 5

Cleaning and Disinfecting

5.1 Universal Precautions

SonoSite recommends that personnel who routinely have exposure to returned medical devices practice “universal precautions.” Universal precautions are an approach to infectious control. It is recommended that those servicing this product follow the prescribed standards for their area.

5.2 Receipt of Suspected Contaminated Materials

- When opening a product returned for service, if visual inspection suggests possible contamination, take proper steps to contain the contamination. Necessary Personal Protective Equipment (PPE) (gloves, masks, and gowns) are worn when opening or examining a package suspected of contamination.
- Prior to transfer to a service area, the suspect package must be labeled as “contaminated” and sealed to prevent exposure.
- Any packing materials removed from a package suspected of contamination must be disposed of in a biohazard container.
- Any contaminated materials received with the product must also be disposed of in an appropriate biohazard container. Contaminated materials may include biohazardous waste and sharps.
- A disinfecting agent should be maintained for use in the event of possible contamination of any work surface. The recommended agent for disinfecting work surfaces is 0.5% sodium hypochlorite (bleach) solution. Prepare the agent by mixing one part household bleach (5.25% - 6% sodium hypochlorite) to nine parts water. The solution may be sprayed or wiped onto the work surface and allowed to air dry.

Use these recommendations when cleaning or disinfecting your ultrasound system, transducers, and accessories. This chapter is intended to assist in effective cleaning and disinfection. It is also intended to protect the system and transducers against damage during cleaning or disinfection.

For more information about cleaning or disinfection solutions or ultrasound gels used with the transducer, call SonoSite technical support or your local representative. For information about a specific product, call the product manufacturer.

5.3 Recommended Disinfectants

For a list of disinfectants recommended for use on the SonoSite ultrasound system and transducers, see the *SonoSite Ultrasound System User Guide*.

CHAPTER 6

Troubleshooting

6.1 System and Subsystem Diagnosis

This section covers basic diagnostic and troubleshooting procedures you may need if the system is not operating properly. To diagnose system failures, consult Table 6.1 and the referenced diagnostic figures that follow.

Table 6.1 Troubleshooting Subassemblies and Diagnostic Figures

SUBASSEMBLIES	DIAGNOSTIC FIGURES
Display	Figure 6.2
External Display	Figure 6.3
Keyboard	Figure 6.4
Trackball	Figure 6.5
System	Figure 6.6
Battery	Figure 6.7

6.2 Subassembly Replacement

The system is repairable through subassembly replacement.

6.3 Test Equipment

There is no test equipment required for this troubleshooting section. Test aids include an external monitor, a spare battery, and a SiteCharge dual battery charger.

6.4 Failures

6.4.1 Display

Display failures can be verified by attaching an external monitor to the external video connector. For example, if the system display is blank and the external video is functioning properly, the system display requires servicing.

6.4.2 Control Panel

Control panel failures can be identified and verified by going to the patient information screen and pressing each individual key on the keyboard. Function keys can be verified by noting their response when pressed.

6.4.3 Trackball

Trackball failures are identified by either intermittent function or loss of control. The trackball can be cleaned by removing the retainer ring and then removing the ball.

6.4.4 Main PCBA

The main PCBA can present symptoms that may be difficult to assess. Main PCBA failures result in “assert codes” that are output to the display. You should note these assert codes and contact SonoSite technical support, per Appendix B, *Service Event Report,* on page 97, for clarification of the failure. Figure 6.1 shows an assert code and a maintenance icon displayed on the system screen.

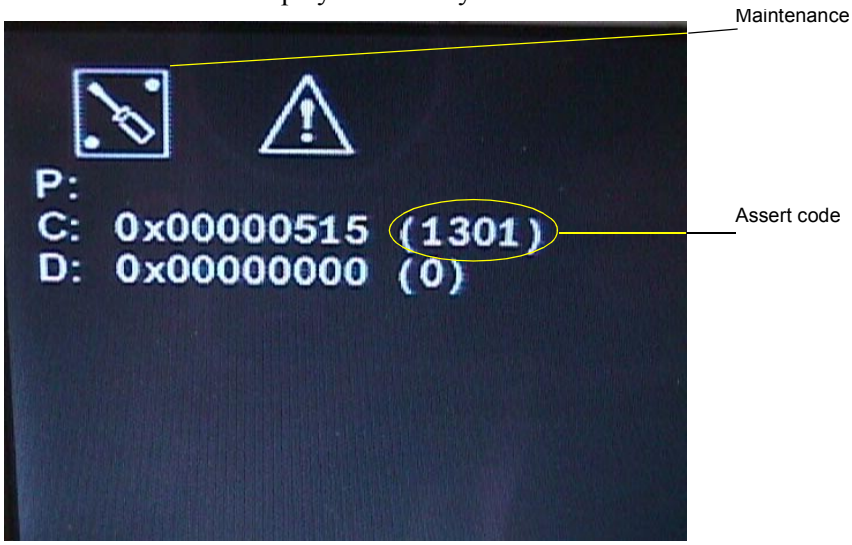


Figure 6.1 Assert Code and Maintenance Icon

6.4.5 Clearing the Main PCBA Failure

After the assert code has been recorded, power down the system.

1. Press the Power switch on the system until the power turns off (approximately 5–10 seconds).
2. Turn the power back on to check if the fault has been cleared or if the condition remains.

   If the condition has cleared, the system may be used. If the condition remains, corrective action must be taken before the system can be used.

6.4.6 Battery

Battery failures are identified when the system does not operate or does not run for the expected duration for a given charge.

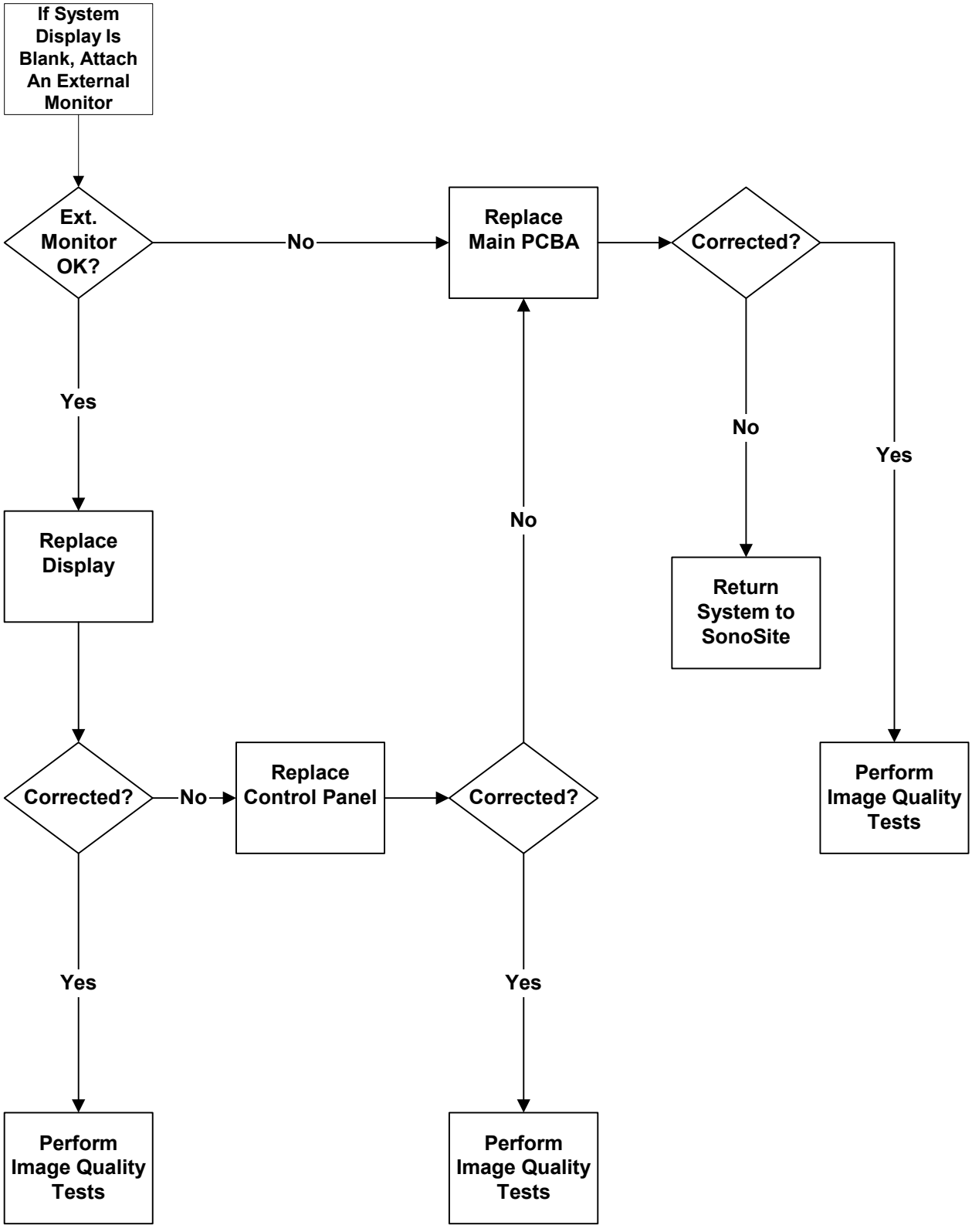


Figure 6.2 Display Diagnosis

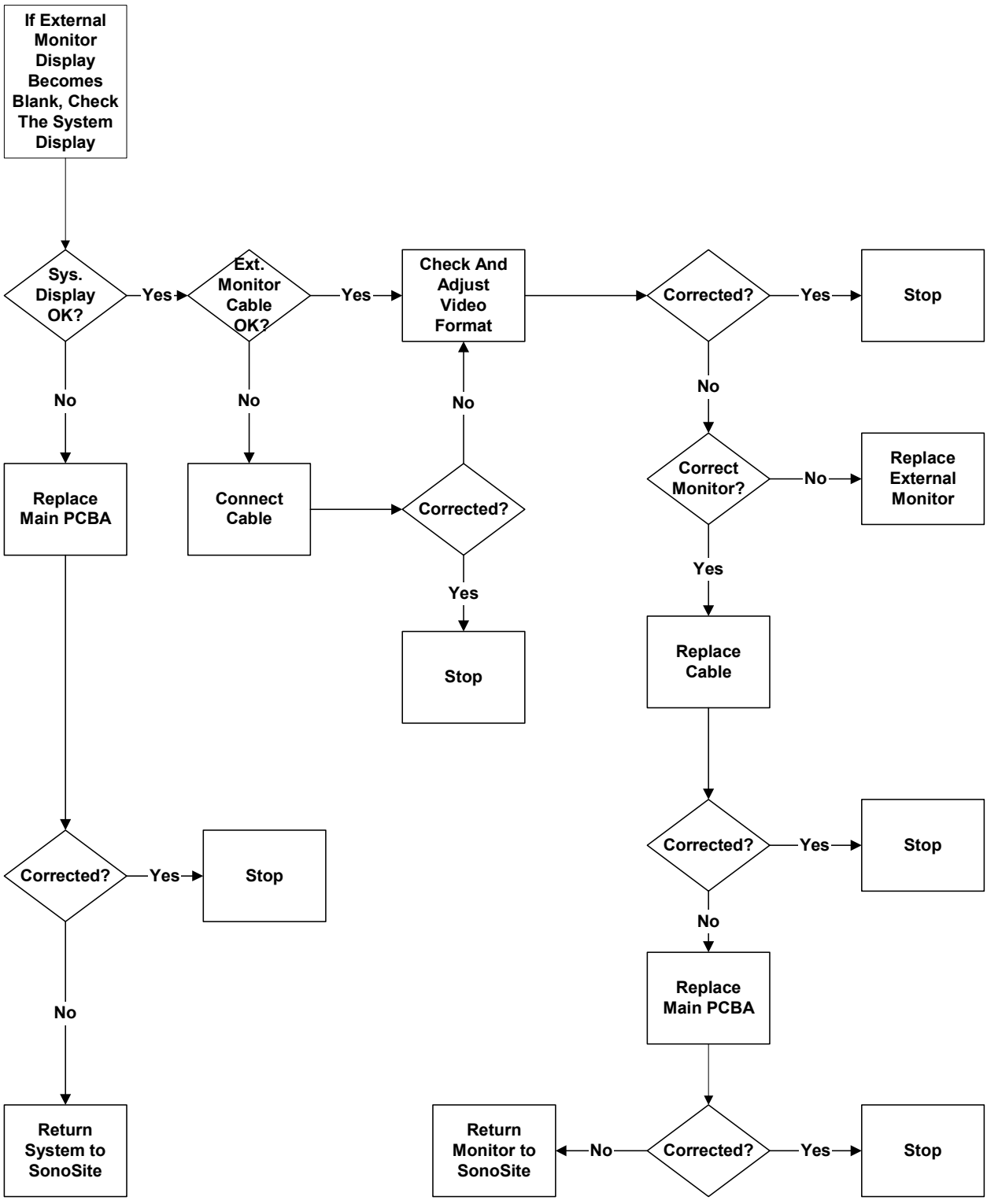


Figure 6.3 External Monitor Diagnosis

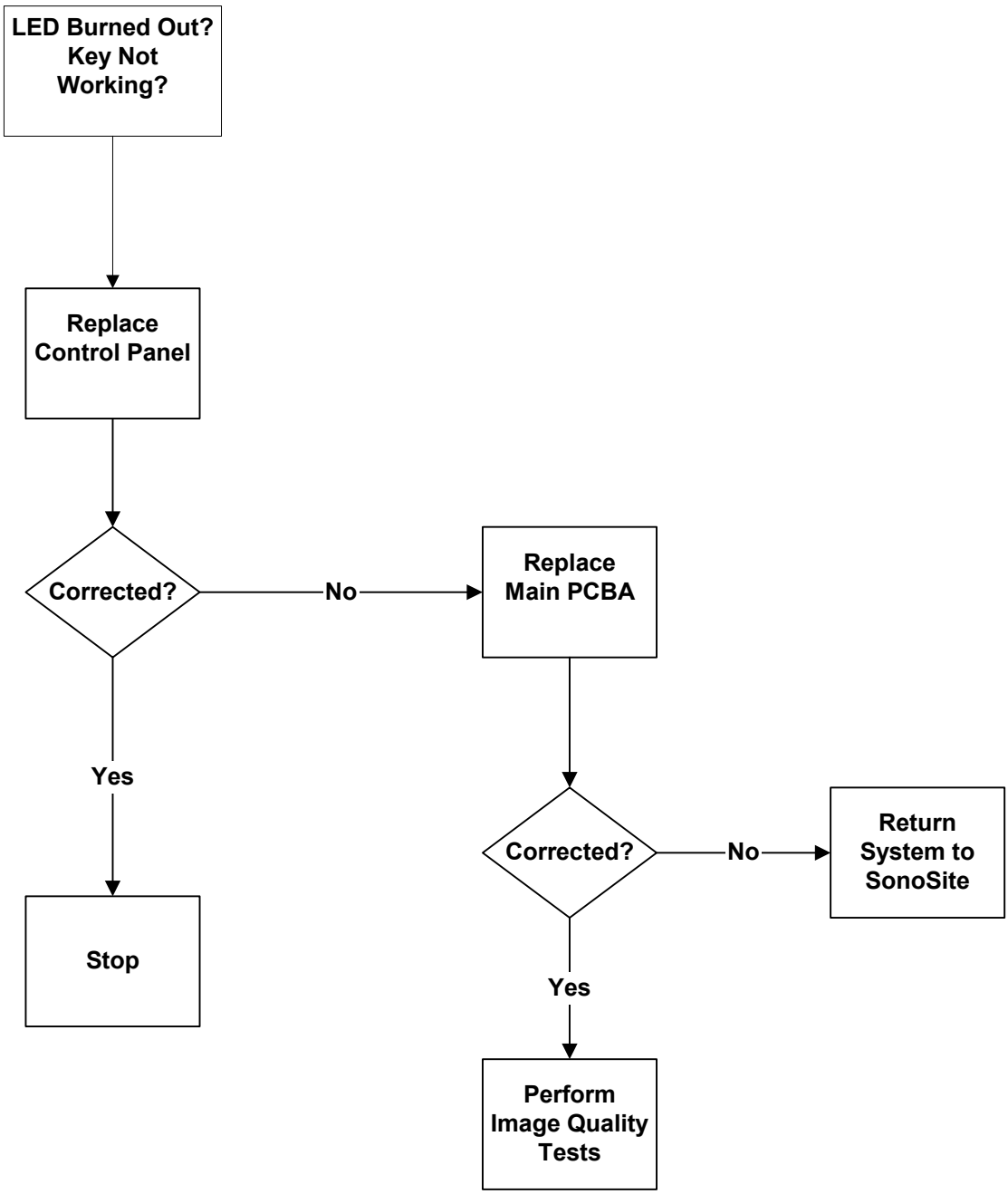


Figure 6.4 Control Panel Diagnosis

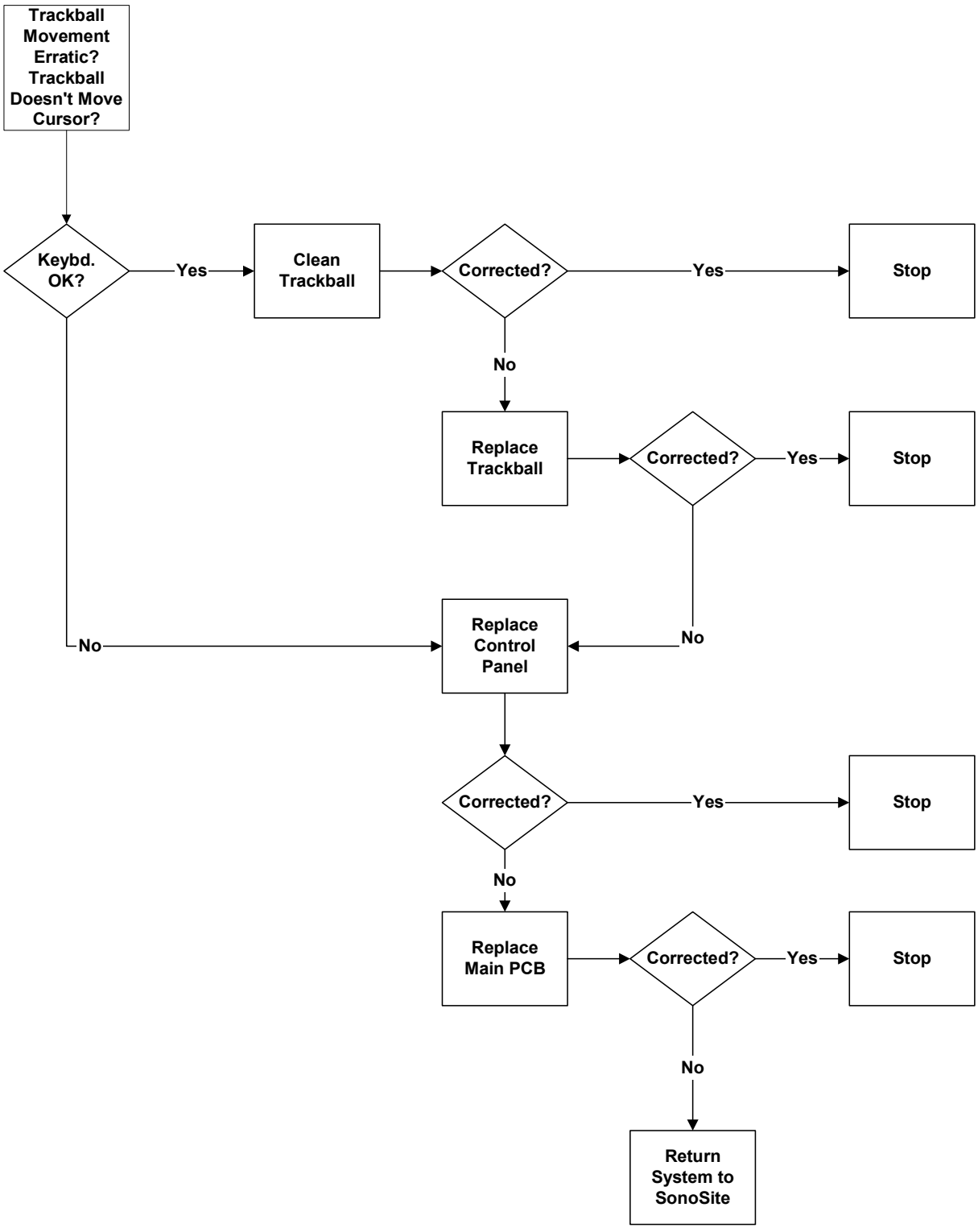


Figure 6.5 Trackball Diagnosis

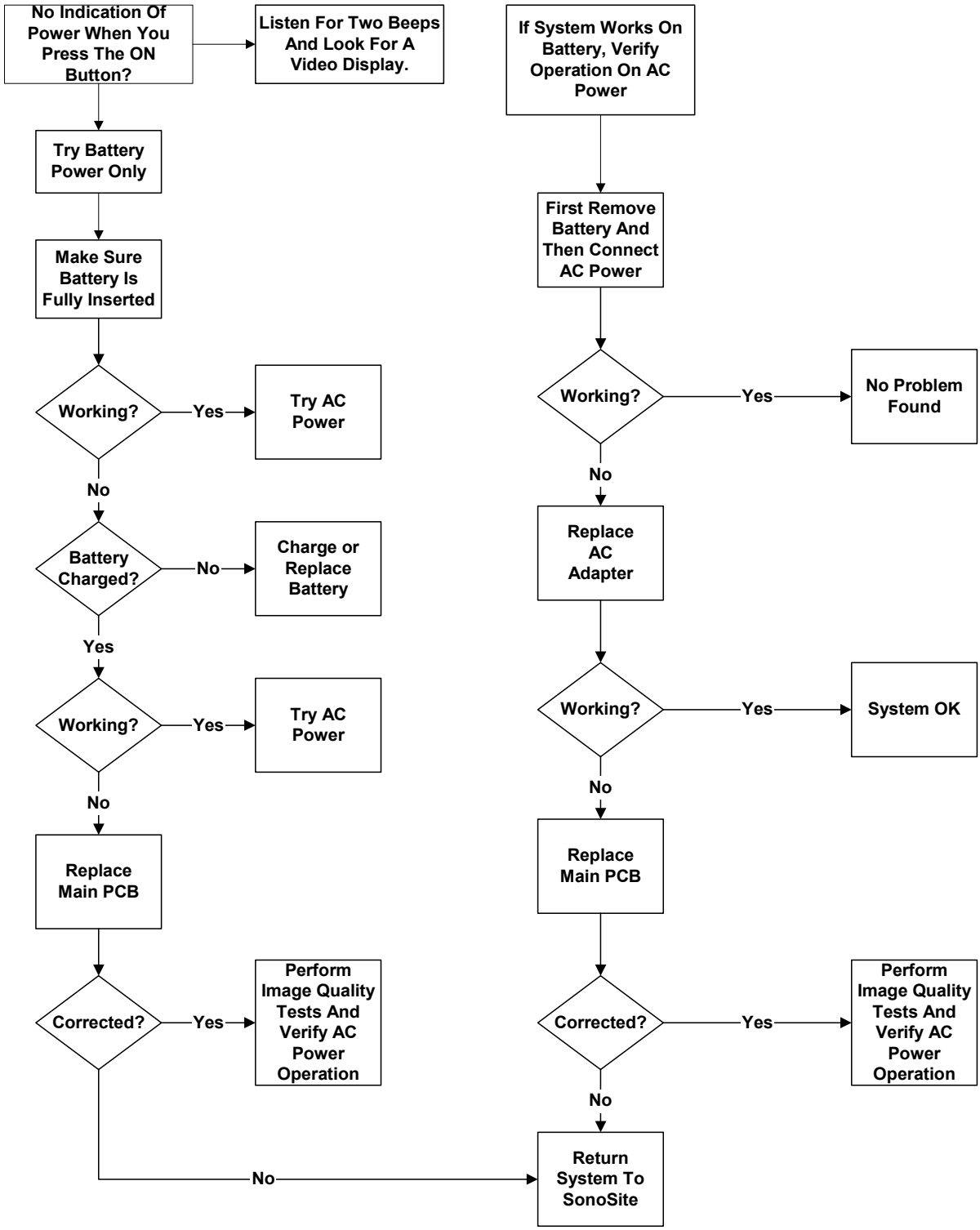


Figure 6.6 System Diagnosis

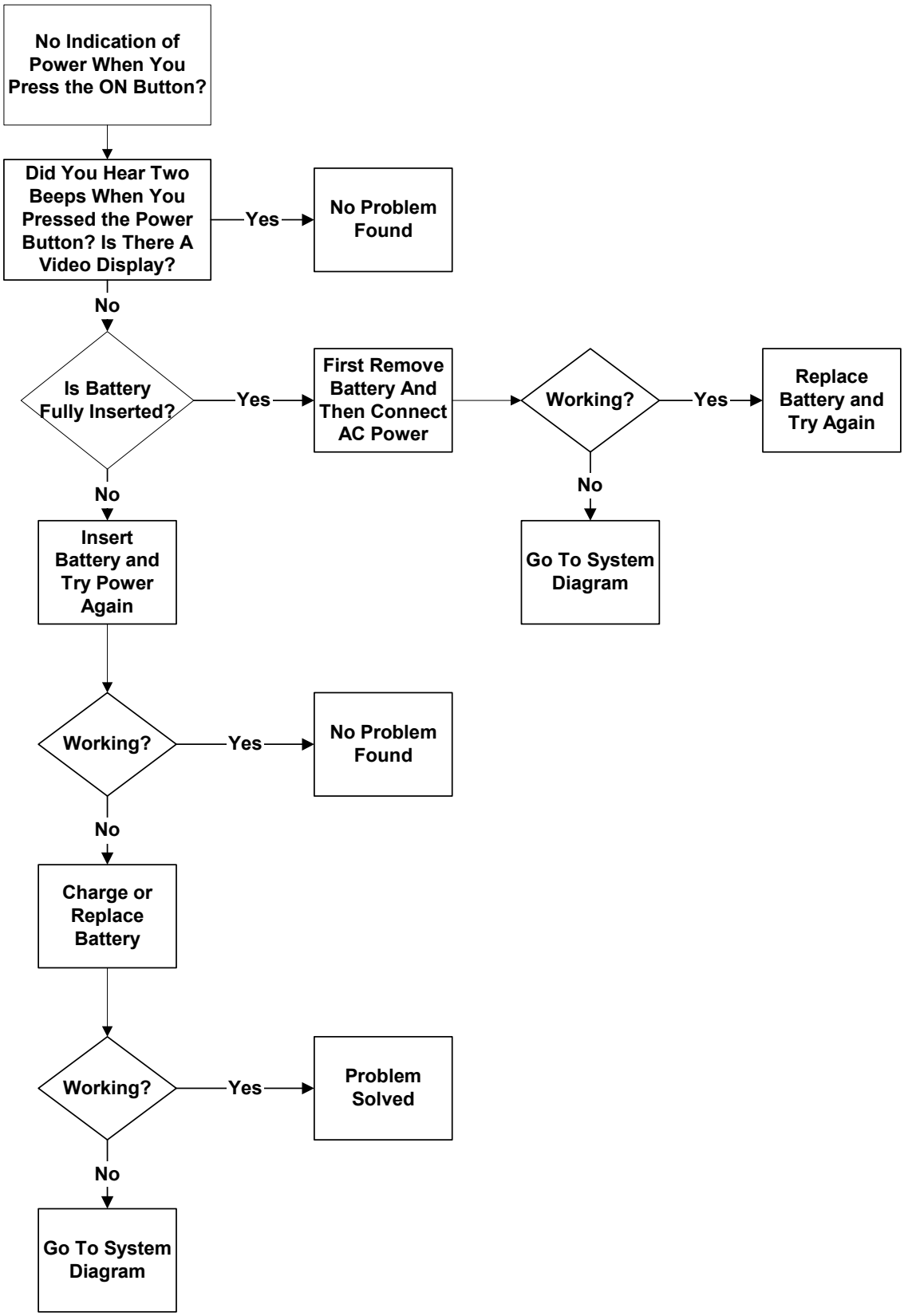


Figure 6.7 Battery Diagnosis

CHAPTER 7

Replacement Procedures

7.1 Display

*Note: Consult **Chapter 6, Troubleshooting,** on page 45 before making any repairs.*

7.1.1 Required Parts

- Service Assembly, Display, SonoSite 180 (P00747) or
- Service Assembly, Display, SonoHeart (P01015) or
- Service Assembly, Display, Hill-Rom (P01407)

7.1.2 Required Tools and Materials

- A #1 Phillips screwdriver, 7.0 in. (17.8 cm / 177.8 mm)
- A torque driver, 2.0–10.0 in./lb (0.23–1.1 newton meter)
- An anti-static mat
- A wrist grounding strap

CAUTION:

- Always use correct ESD procedures. ESD damage is cumulative and may not be noticeable at first. ESD symptoms may be first exhibited as a slight degradation of performance or image quality.

7.1.3 Removing the Display

1. Press the battery release on the lower right side of the system to remove the system battery.
2. Use a #1 Phillips screwdriver to remove the two screws in the battery compartment, which releases the Control Panel from the top housing (Figure 7.1).

Figure 7.1 Removing the Control Panel

3. Insert an anti-static mat between the Control Panel and the Display to prevent damaging the Display (Figure 7.2).
4. Lay the Control Panel over onto the Display to expose the wire harness and flex circuits.
5. Carefully disconnect the 100-pin flex circuit from the bottom module.
6. Disconnect the Display Wire Harness and unlatch two flex circuits connectors from the Control Panel (Figure 7.2).
7. Set the Control Panel aside.

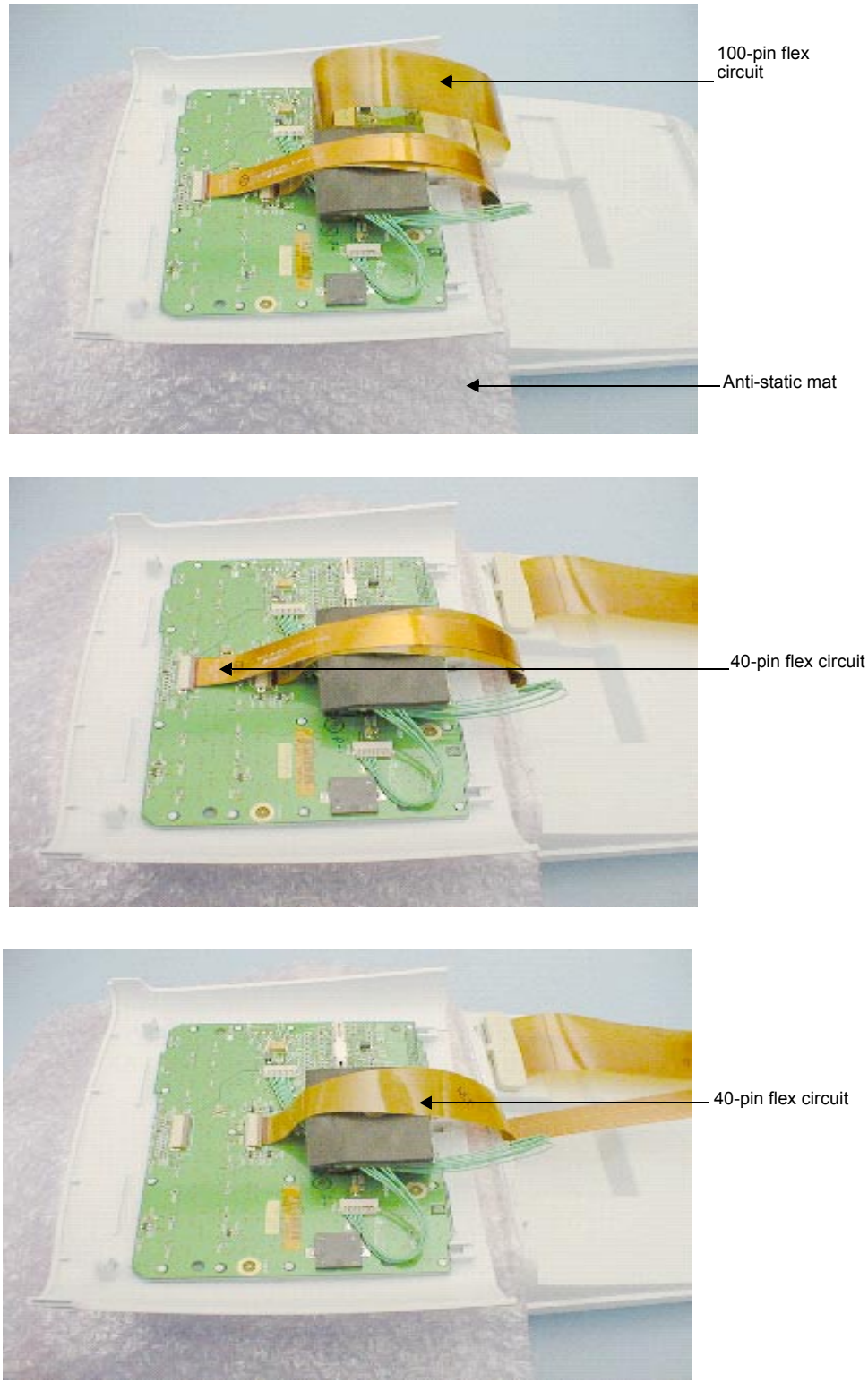


Figure 7.2 Disconnecting the Display Wire Harness and Flex Circuits

8. Use a #1 Phillips screwdriver to remove the four screws securing the Display hinges to the top housing (Figure 7.3).

9. Carefully guide the ends of the Display Wire Harness and two 40-pin flex circuits out through the slot in the top housing and remove the old Display.

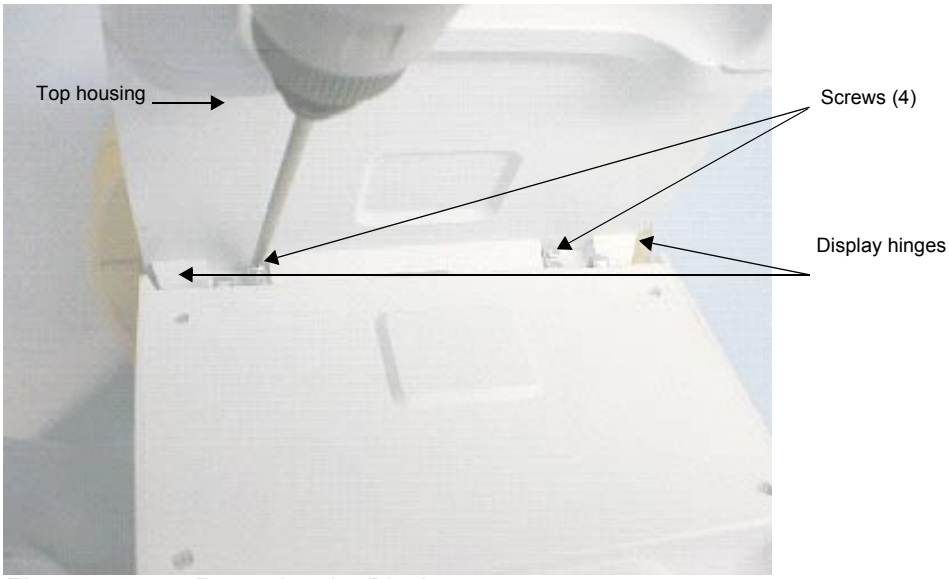


Figure 7.3 Removing the Display

7.1.4 Replacing the Display

1. Carefully guide the ends of the replacement Display Wire Harness and two 40-pin flex circuits through the slot in the top housing (Figure 7.4).

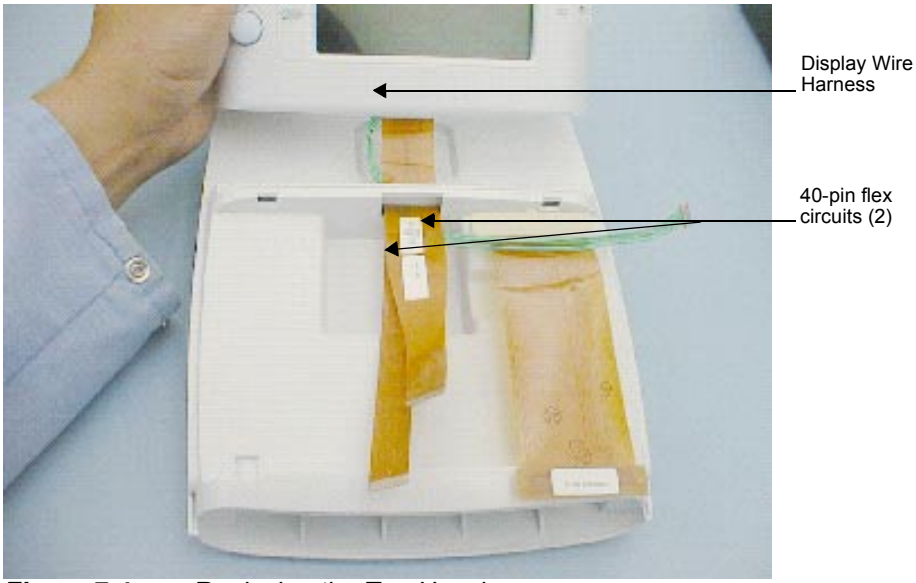


Figure 7.4 Replacing the Top Housing

2. Use a #1 Phillips screwdriver to secure the four screws on the replacement Display hinges to the top housing (Figure 7.3). Torque screws to 6.1 in./lb (0.7 newton meter).

3. Place the Control Panel onto the Display.

4. Install the Display Wire Harness and flex circuits.

Note: Verify the reference designators on the flex circuits match the reference designators on the PCBA connectors.

5. Replace the 100-pin flex circuit on the bottom module (Figure 7.5).

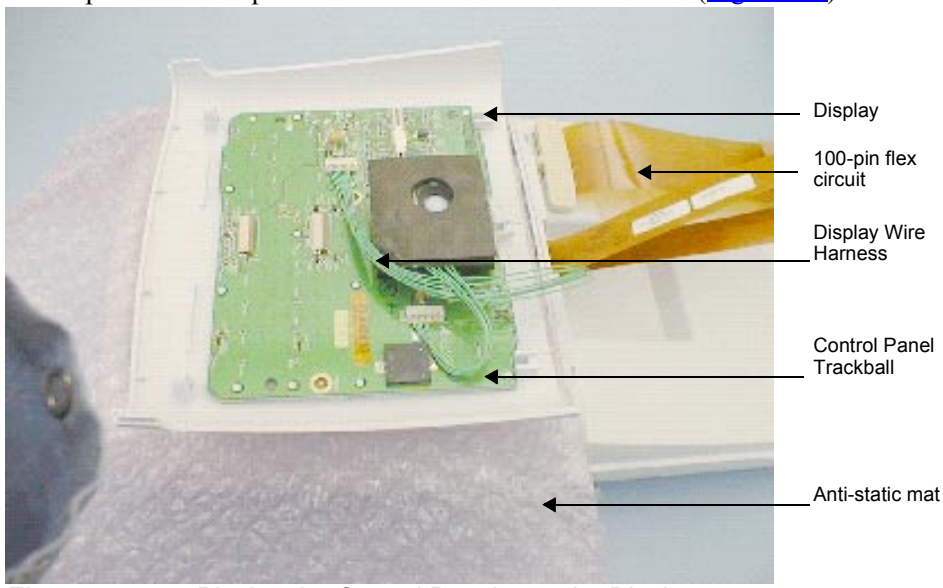


Figure 7.5 Placing the Control Panel onto the Display

6. Carefully replace the Control Panel by inserting the tabs on the top of the Display into the slots.

7. Set the Control Panel into place and replace the two screws inside the battery compartment (Figure 7.6). Torque screws to 7.1 in./lb (0.8 newton meter).

8. Place the battery in the battery compartment.

9. Turn on the system.

10. Perform the Display tests in **Chapter 8, *Performance Tests,*** on page 77 to verify that the Display is functioning properly.

7.2 Control Panel

7.2.1 Required Parts

- Service Assembly, Control Panel, English (P00735), or
- Service Assembly, Control Panel, French (P00736), or
- Service Assembly, Control Panel, German (P00737), or
- Service Assembly, Control Panel, Spanish (P00738), or
- Service Assembly, Control Panel, Portuguese (P00739), or
- Service Assembly, Control Panel, Italian (P00740), or
- Service Assembly, Trackball (P00741)

Note: The Service Assembly, Control Panel does not include a trackball. To install a trackball, see Section 7.3, Trackball, on page 64.

7.2.2 Required Tools

- A #1 Phillips screwdriver, 7.0 in. (17.8 cm / 177.8 mm)
- A torque driver, 2.0–10.0 in./lb (0.2–1.1 newton meter)
- An anti-static mat
- A wrist grounding strap

7.2.3 Removing the Control Panel

1. Press the battery release on the lower right side of the system to remove the system battery.
2. Use a #1 Phillips screwdriver to remove the two screws in the battery compartment, which releases the Control Panel from the top housing (Figure 7.6).

Figure 7.6 Removing the Control Panel

3. Insert an anti-static mat between the Control Panel and the Display to prevent damaging the Display.
4. Carefully lay the Control Panel over onto the Display to expose the Display Wire Harness and the two 40-pin flex circuits.
5. Carefully disconnect the 100-pin flex circuit from the bottom module.
6. Disconnect the Display Wire Harness and the two 40-pin flex circuits from the Control Panel (Figure 7.7).
7. Remove the Control Panel.

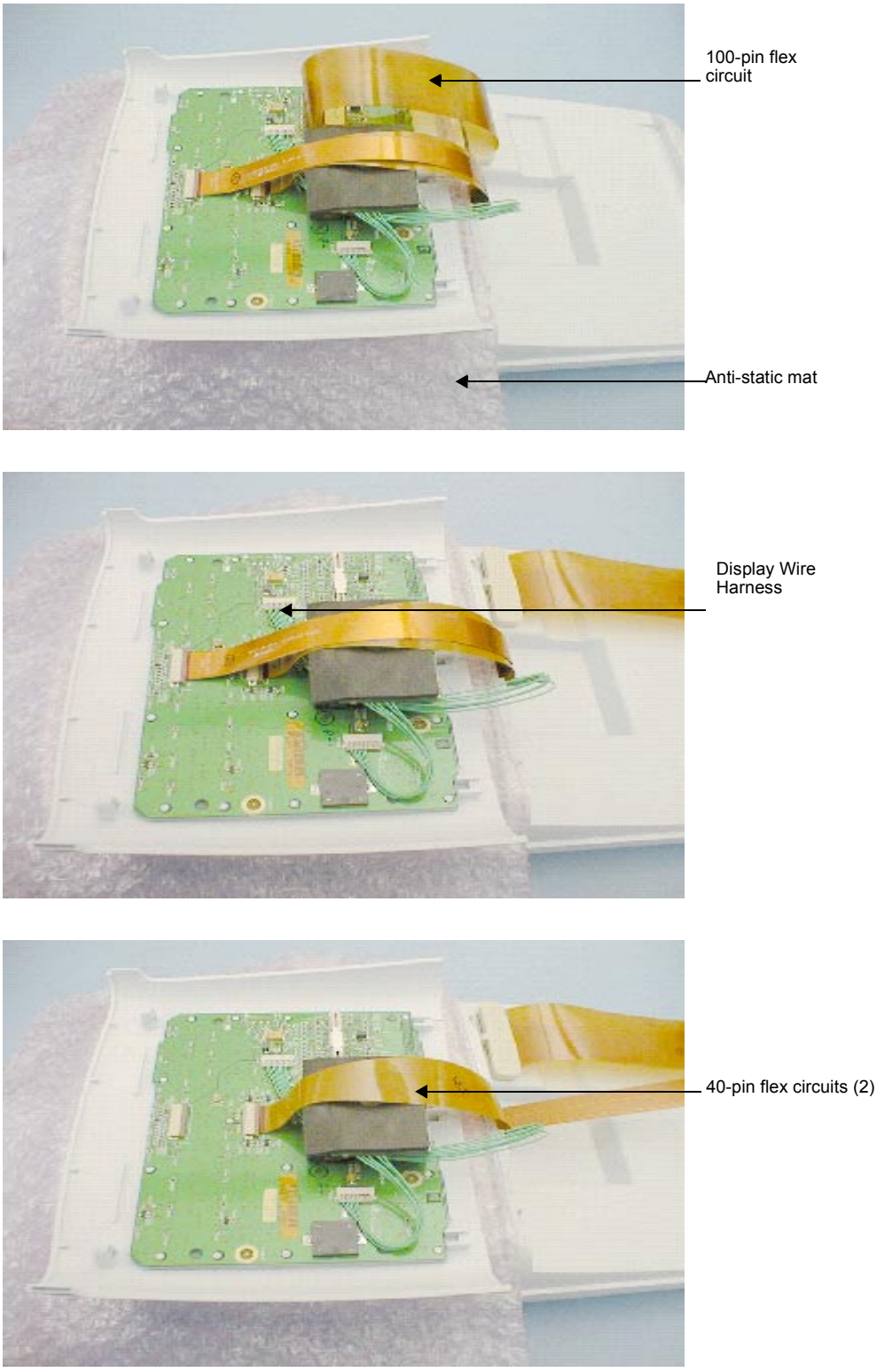


Figure 7.7 Disconnecting the Control Panel

7.2.4 Replacing the Control Panel

1. Place the Control Panel onto the Display.
2. Install the wire harness and the two 40-pin flex circuits.
3. Replace the 100-pin flex circuit on the bottom module (Figure 7.7).
4. Carefully replace the Control Panel by inserting the tabs on the top of the assembly into the slots.
5. Set the Control Panel into place and use a #1 Phillips screwdriver to replace the two screws inside the battery compartment. Torque the screws to 7.1 in./lb (0.8 newton meter) (Figure 7.8).

Figure 7.8 Replacing the Control Panel

6. Place the battery in the battery compartment.
7. Turn on the system.
8. To verify proper operation of the new Control Panel, perform the Control Panel tests in **Chapter 8, *Performance Tests,*** on page 77.

7.3 Trackball

7.3.1 Required Parts

- Service Assembly, Trackball (P00741)

7.3.2 Required Tools

- A #1 Phillips screwdriver, 7.0 in. (17.8 cm / 177.8 mm)
- A torque driver, 2.0–10.0 in./lb (0.2–1.1 newton meter)
- A small, blunt punch
- An anti-static mat
- A wrist grounding strap

7.3.3 Removing the Trackball

1. Press the battery release on the lower right side of the system to remove the system battery.
2. Use a #1 Phillips screwdriver to remove the two screws in the battery compartment, which releases the Control Panel from the top housing (Figure 7.8).
3. Insert an anti-static mat between the Control Panel and the Display to prevent damaging the Display.
4. Lay the Control Panel over onto the Display to expose the wire harness and flex circuits.
5. Carefully disconnect the 100-pin flex circuit from the bottom module.
6. Disconnect the Display Wire Harness and the two 40-pin flex circuits from the Control Panel.
7. Remove the Control Panel.
8. Remove the trackball retaining ring. Carefully insert the tip of a blunt punch into the indent, turn the trackball retaining ring slightly counterclockwise. This will release it and allow you to remove it (Figure 7.9).

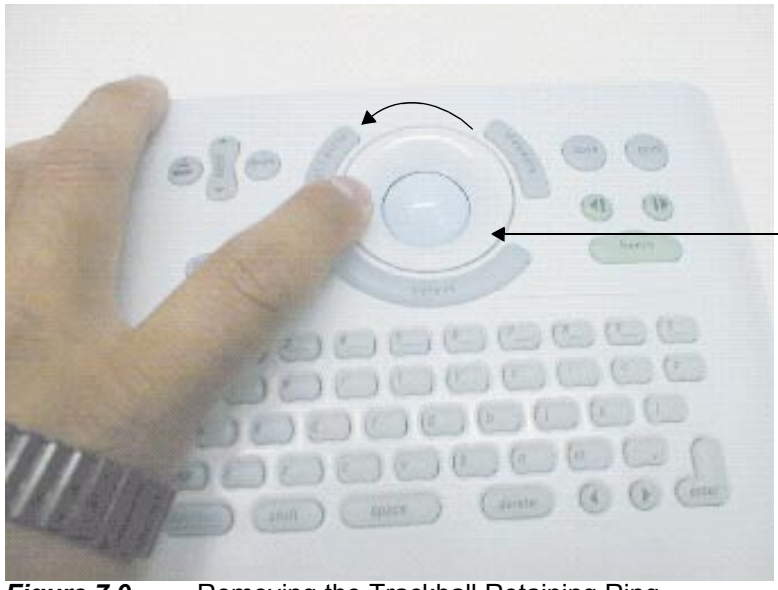


Figure 7.9 Removing the Trackball Retaining Ring

9. Remove the ball.

10. Disconnect the Trackball Wire Harness from the Control Panel.

11. Remove the foam backing from the Trackball to expose the four screws connecting the Trackball to the Control Panel (Figure 7.10).

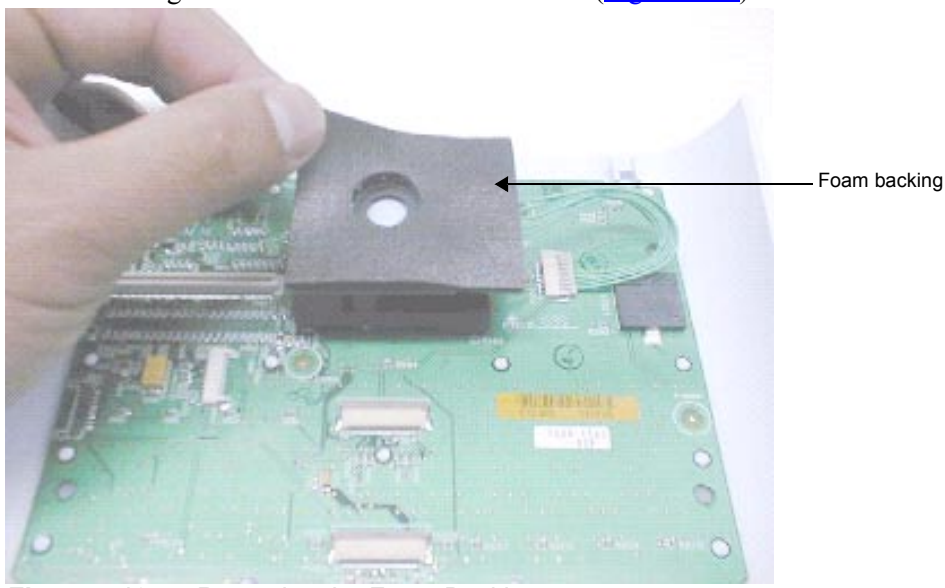


Figure 7.10 Removing the Foam Backing

12. Use a #1 Phillips screwdriver to remove the four screws that secure the Trackball to the Control Panel (Figure 7.11).

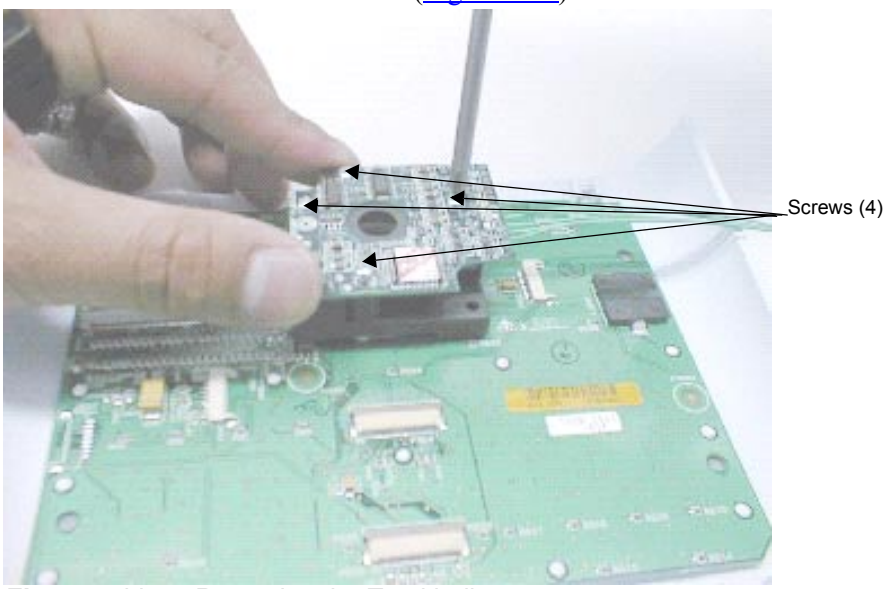


Figure 7.11 Removing the Trackball

13. Holding the Trackball in place, carefully turn the Control Panel over and allow the Trackball to drop off of the Control Panel, so as not to lose the pieces of the Trackball (Figure 7.12).

14. Remove the Trackball and note the locations of its components.

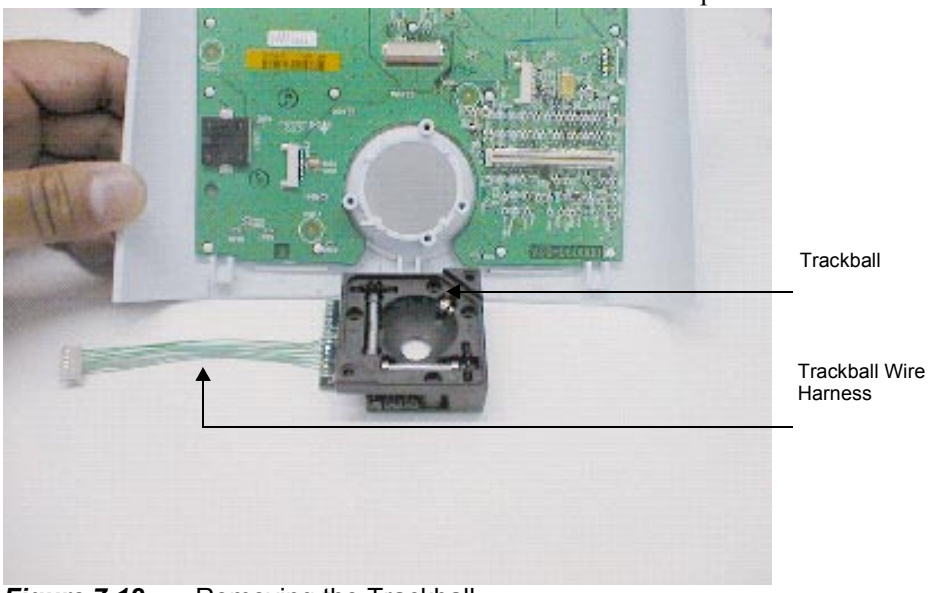


Figure 7.12 Removing the Trackball

7.3.4 Replacing the Trackball

1. Use a #1 Phillips screwdriver to remove the four screws holding the top cover onto the Trackball. Discard the cover and the four screws. Be careful not to tip the Trackball, which could cause the parts from the Trackball to spill (Figure 7.12).
2. Holding the Trackball, carefully turn the Control Panel over onto the new Trackball and set it into place.
3. Once in place, carefully turn the Trackball over holding the Trackball in place.
4. Use a #1 Phillips screwdriver to tighten the four screws securing the Trackball (Figure 7.13). Torque the screws to 3.6 in./lb (0.4 newton meter).

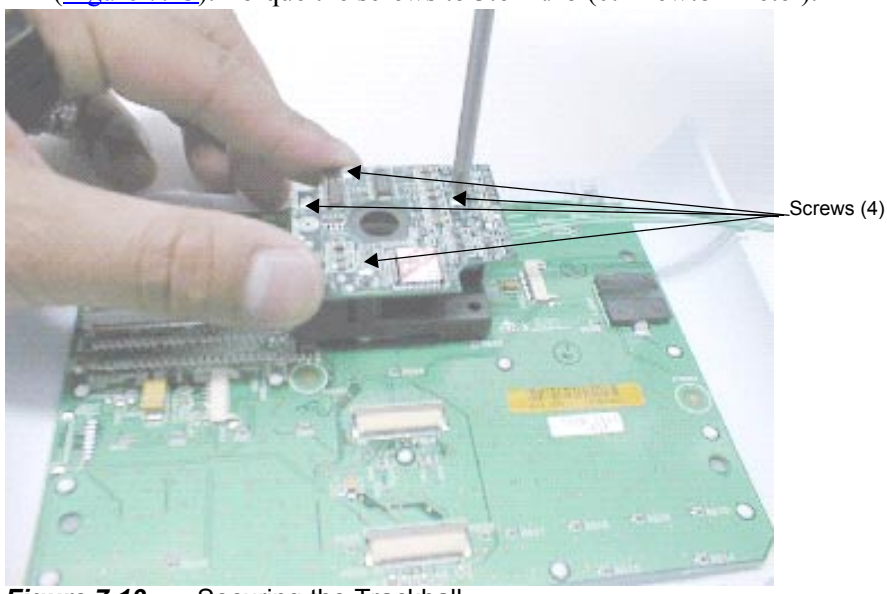


Figure 7.13 Securing the Trackball

5. Place the foam backing on the Trackball (Figure 7.14).

Figure 7.14 Placing the Foam Backing

6. Turn the Control Panel over and install the new trackball retaining ring. Use your fingers to press and turn the ring slightly clockwise until it locks into place (Figure 7.15).

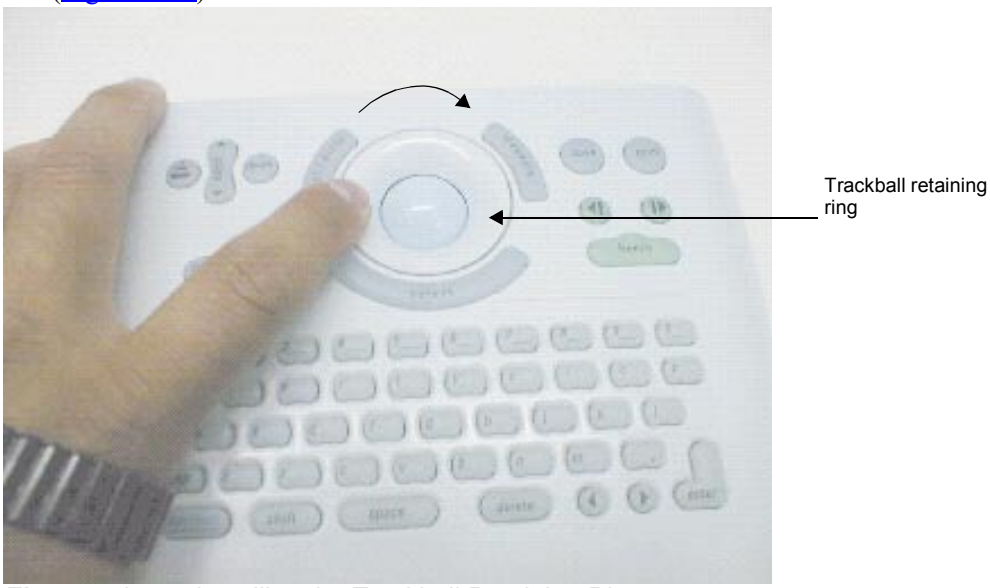


Figure 7.15 Installing the Trackball Retaining Ring

7. Turn the Trackball over and secure the Trackball Wire Harness to the Control Panel.
8. Place the Control Panel onto the Display.
9. Install the Display Wire Harness and the two 40-pin flex circuits (Figure 7.16).
10. Replace the 100-pin flex circuit on the bottom module.

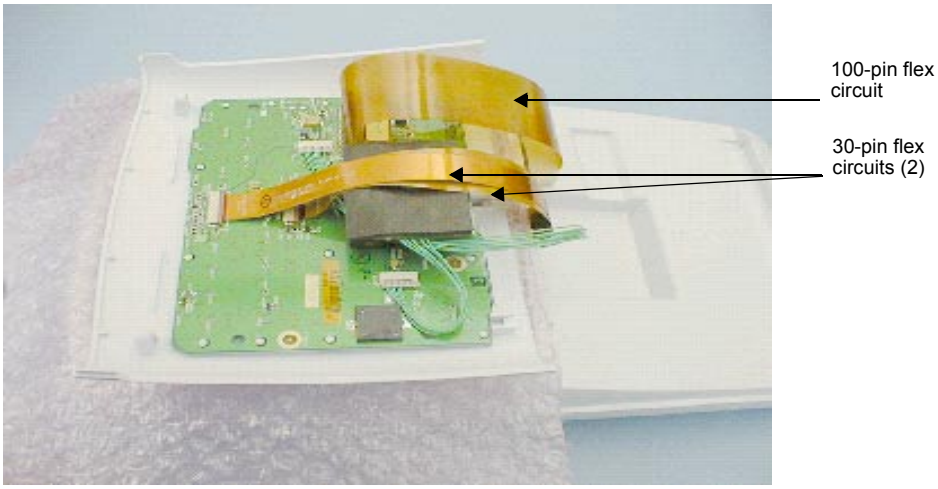


Figure 7.16 Installing the Display Wire Harness and Flex Circuits

11. Carefully replace the Control Panel by inserting the tabs on the top of the Control Panel into the slots.

12. Set the Control Panel into place and replace the two screws inside the battery compartment (Figure 7.17). Torque the screws to 7.1 in./lb (0.8 newton meter).

Figure 7.17 Replacing the Control Panel

13. Place the battery in the battery compartment.

14. Turn on the system.

15. Perform the trackball tests in **Chapter 8, *Performance Tests,*** on page 77 to verify the proper operation of the new trackball.

7.4 Main PCBA

7.4.1 Required Parts

- Service Assembly, PCB C1.75 Main, English (P01393), or
- Service Assembly, PCB C1.75 Main, French (P01394), or
- Service Assembly, PCB C1.75 Main, German (P01395), or
- Service Assembly, PCB C1.75 Main, Spanish (P01398), or
- Service Assembly, PCB C1.75 Main, Portuguese (P01397), or
- Service Assembly, PCB C1.75 Main, Italian (P01396), or
- Service Assembly, PCB C1.75 Main, Japan (P01399)

- Service Assembly, PCB C1.75 Main, SonoHeart, English (P01400), or
- Service Assembly, PCB C1.75 Main, SonoHeart, French (P01401), or
- Service Assembly, PCB C1.75 Main, SonoHeart, German (P01402), or
- Service Assembly, PCB C1.75 Main, SonoHeart, Spanish (P01405), or
- Service Assembly, PCB C1.75 Main, SonoHeart, Portuguese (P01404), or
- Service Assembly, PCB C1.75 Main, SonoHeart, Italian (P01403)
- Service Assembly, PCB C1.75 Main, SonoHeart, Japanese (P01406)

7.4.2 Required Tools

- A #1 Phillips screwdriver, 7.0 in. (17.8 cm / 177.8 mm)
- A torque driver, 3.6 in./lb (0.4 newton meter)
- An anti-static mat
- A wrist grounding strap

7.4.3 Removing the Main PCBA

1. Press the battery release on the lower right side of the system to remove the system battery.
2. Place the system face down.

3. Use a #1 Phillips screwdriver to remove the eight screws securing the bottom housing to the top housing (Figure 7.18).

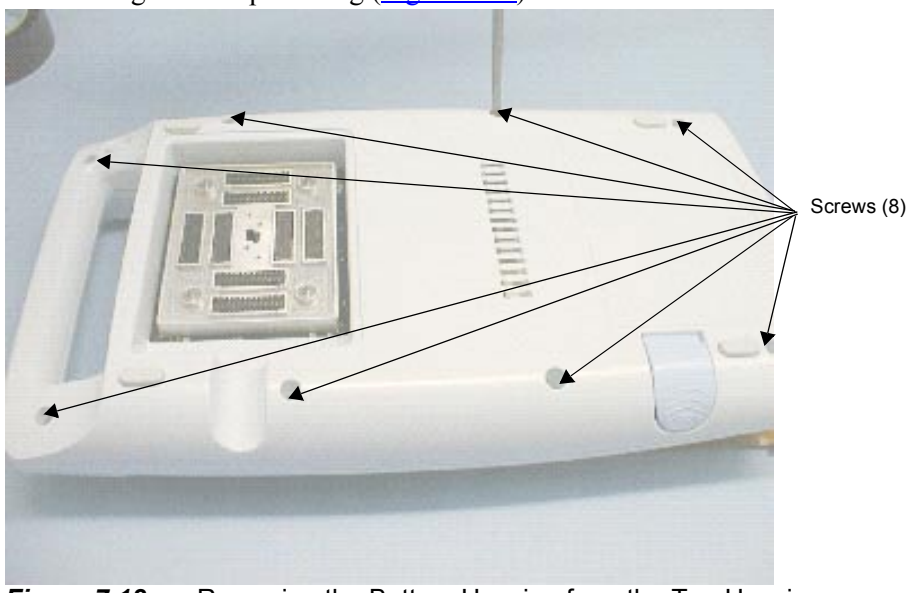


Figure 7.18 Removing the Bottom Housing from the Top Housing

4. Carefully separate the bottom housing from the top housing; do not damage the 100-pin flex circuit that connects the two together.

5. Disconnect the 100-pin flex circuit from the Main PCBA.

6. Remove the bottom housing that holds the Main PCBA.

7. Use a #1 Phillips screwdriver to remove the four screws that connect the Main PCBA to the bottom housing (Figure 7.19).

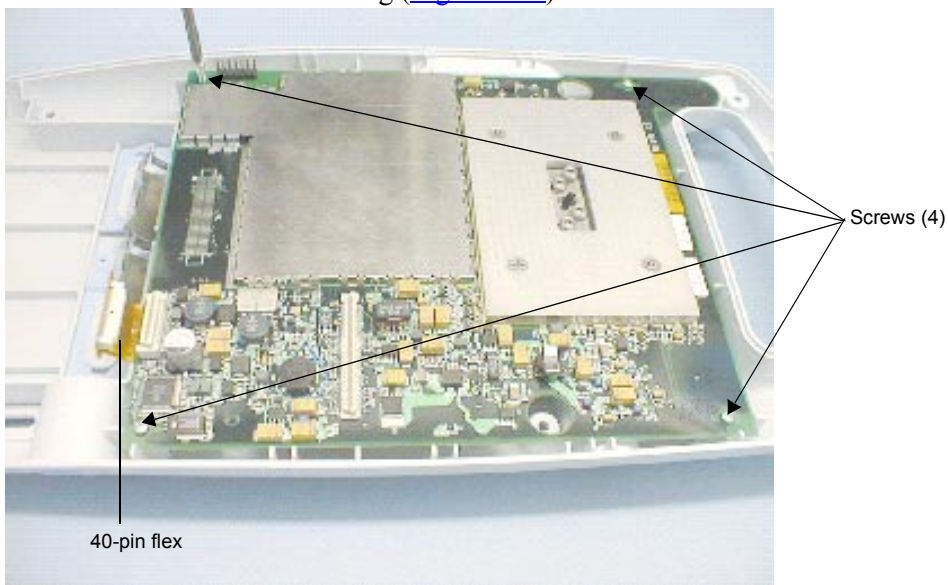


Figure 7.19 Removing the Main PCBA from the Bottom Housing

8. Carefully disconnect the 40-pin flex circuit that connects the Main PCBA to the Dock Interface PCBA (located under the Main PCBA).

9. Remove the Main PCBA.

7.4.4 Replacing the Main PCBA

1. Set the replacement Main PCBA onto the bottom housing (Figure 7.20).

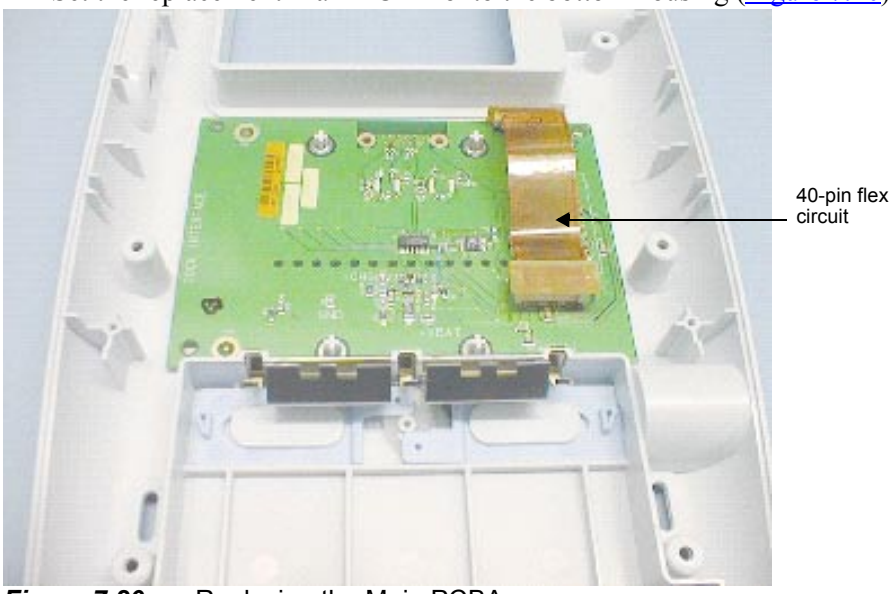


Figure 7.20 Replacing the Main PCBA

2. Secure the four screws that connect the Main PCBA to the bottom housing (Figure 7.21). Torque the screws to 3.6 in./lb (0.4 newton meter).

3. Connect the 40-pin flex circuit to the Main PCBA.

4. Carefully set the top housing onto the bottom housing, connecting the 100-pin flex circuit as it sets into position (Figure 7.22).

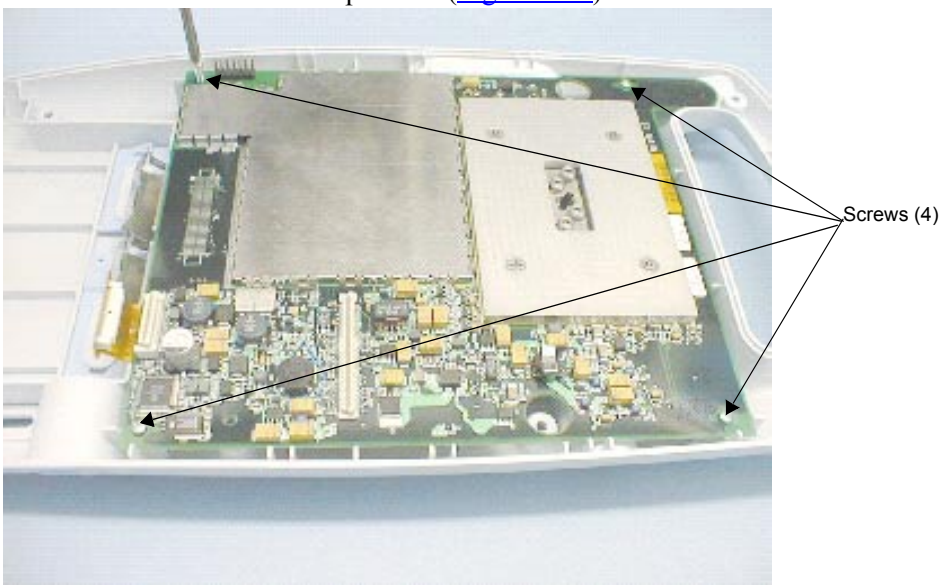


Figure 7.21 Securing the Main PCBA to the Bottom Housing

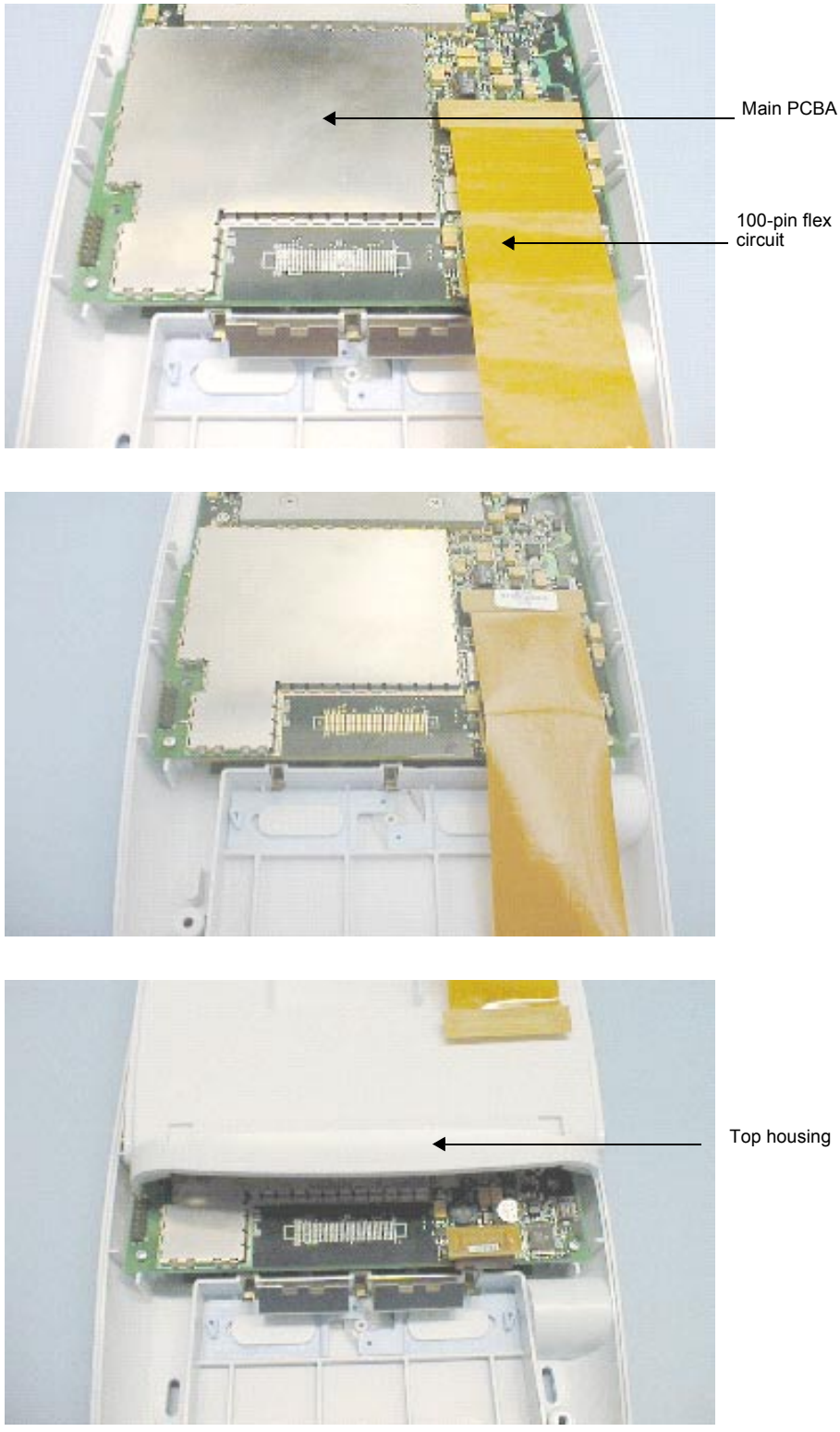


Figure 7.22 Setting the Top Housing Onto the Bottom Housing

5. Carefully mate the bottom housing to the top housing and use the #1 Phillips screwdriver to secure the eight screws (Figure 7.23). Torque the screws to 7.1 in./lb (0.8 newton meter).

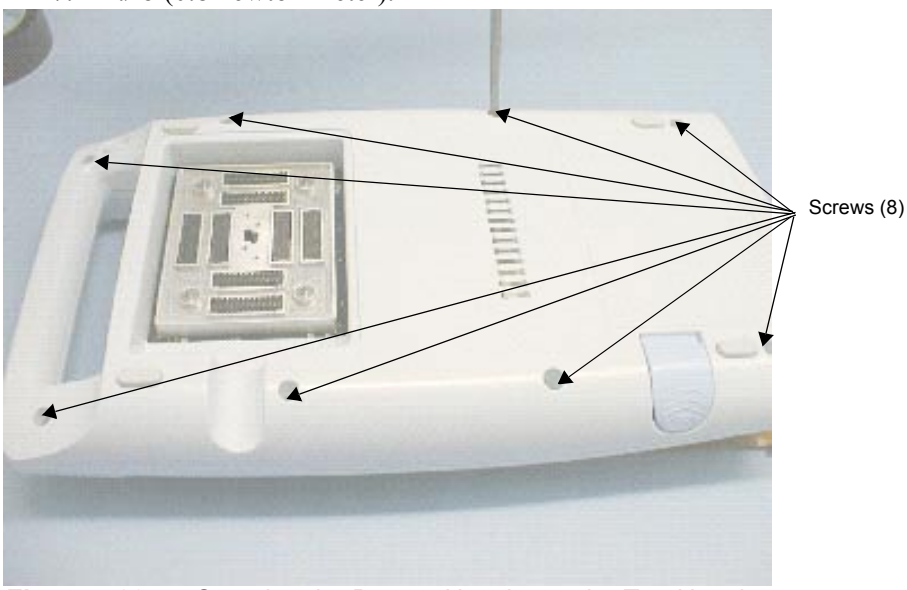


Figure 7.23 Securing the Bottom Housing to the Top Housing

6. Place the battery into the battery compartment.
7. Turn on the system.
8. Verify that the Main PCBA is functioning properly by performing the tests in **Chapter 8, *Performance Tests,*** on page 77.

7.5 Transducers

There are no user-serviceable parts identified for the transducers. Return transducers to SonoSite for exchange during the warranty period.

7.6 SiteCharge Dual Battery Charger

There are no user-serviceable parts identified for the SiteCharge dual battery charger. Return chargers to SonoSite for exchange during the warranty period.

7.7 AC Power Adapter

There are no user-serviceable parts identified for the AC power adapter. Return power adapters to SonoSite for exchange during the warranty period.

7.8 Peripherals

If you need assistance in locating a service center near you, contact SonoSite technical support.

7.8.1 Display

To return a failed display, contact the Sony Service Center at 714-220-9100. For service, ship the display to the original OEM or send Sony displays to the following address:

Sony Service Center
10833 Valley View
Cypress, CA 90630
United States

7.8.2 VCR

To return a failed VCR, contact the Sony Service Center at 800-282-2848 or 972-931-2497. For service, ship the VCR to the original OEM for service or send Sony VCRs to the following address:

Sony Electronics, Inc.
7517 Campbell Road
Dallas, TX 75248
United States

7.8.3 Printer

To return a failed printer, contact the Sony Service Center at 770-263-9888. For service, ship the printer to the original OEM or send Sony printers to the following address:

Sony Service
3175 A Northwood Parkway
Norcross, GA 90071
United States

CHAPTER 8

Performance Tests

8.1 Overview

WARNING:

- **Critical Test Function -** A failure of the system function tested in this section could adversely affect safety or effectiveness of the system. While performing the steps in this section, verify that the images on the system display and on the external monitor are acceptable.
- Verify that all controls operate smoothly over their full range and that the system responds properly.
- To obtain 2D images, SonoSite recommends using the RMI 413A Soft Tissue Phantom, the RMI 403 GS Multipurpose Phantom, or the equivalent.
- To obtain Power Doppler images, SonoSite recommends using the RMI 425 Doppler Phantom, the RMI 1425A Doppler Phantom, or the equivalent.
- When making penetration measurements on a phantom, apply the phantom reference value and tolerance to the measurement.

8.2 Test Equipment:

- SonoSite ultrasound system with a C60/5-2 MHz transducer
- RMI 413A Soft Tissue Phantom, the RMI 403 GS Multipurpose Phantom, or the equivalent
- RMI 425 Doppler Phantom, the RMI 1425A Doppler Phantom, or the equivalent
- Acoustic gel

8.3 Setting Up Performance Tests

To set up the performance tests:

1. Attach the C-60/5-2 MHz transducer to the system.
2. Select **general** for optimization and **OB** for exam type.
3. Couple the transducer to the phantom, adjusting gain settings and transducer for a proper phantom image (e.g., pins are high level echoes positioned in straight lines; cysts are sonolucent, edges are sharp, and graphite particles of the phantom are mid grays).

8.3.1 Scan Reference Orientation

1. Verify that the correct transducer name appears in the upper right corner of the system display.
2. Verify that the scan plane orientation mark in the image located near the skinline corresponds to element #1 on the transducer. This can be tested by putting your finger on the probe and running it across the transducer face. Your finger touching the transducer face as indicated above should show up at the orientation mark on the image format on the monitor.
3. With the array pointing down and the orientation mark to the operator's left, element #1 corresponds with the left side of the array.

8.4 Testing 2D Performance

To test 2D performance:

1. Use a C60/5-2 MHz transducer in 2D mode.
2. Adjust the position of the C60/50-2 MHz transducer on the phantom.
3. Use the 2D system controls to obtain an image that clearly shows both the horizontal and vertical rows of pins.

8.4.1 2D Image Quality

To test 2D image quality:

1. Verify the ultrasound image appears uniform in both the axial and lateral direction without any dropouts or intensity variations.
2. Verify the cystic structure at the focal zone is clearly differentiated from the surrounding tissue and is echo-free; while solid tissue, with numerous echo sources, appears solid.

8.4.2 Axial Measurement Accuracy

Note: Measurements must be performed while the image is frozen.

To test axial accuracy:

1. Acquire the image.
2. Press **freeze**.
3. Press **measure**. Two calipers appear on the image display. A menu appears on which are listed two **distance** icons, an **ellipse** icon, a **delete** icon, and a **calcs** icon, if applicable. (If the **caliper line** setup is on, then a dotted line connects the two calipers. See the *SonoSite 180 or SonoHeart User Guide*, if necessary.) The first caliper in the menu is active by default.
4. Use the **trackball** to position one of the calipers.
5. Press **select** to fix the caliper and enable the other caliper.
6. Use the **trackball** to move the other caliper. The results update as you move the caliper, and the measurement is complete when you finish moving the calipers. (Press **select** to alternate the active caliper, and adjust the measurement with the **trackball**.)
7. You can perform another distance measurement on the image by selecting the other **distance** icon and repeating the preceding steps.
8. Measure the distance, center to center, of two pins that are 5-12 cm apart vertically.
9. Verify the distance measured is within the tolerance listed in Table 8.1.

8.4.3 Lateral Measurement Accuracy

To test the lateral measurement accuracy:

1. Perform steps 1 through 7 in *Section 8.4.2*.
2. Measure the distance, center to center, of the two pins that are 4-10 cm apart horizontally.
3. Verify the distance measured is within the tolerance listed in Table 8.1.
4. Press **freeze** to return the system to live 2D mode.

Table 8.1 System Measurement Accuracy

MEASUREMENTS	TOLERANCE
Axial Distance	+/- 2%
Lateral Distance	+/- 2%

8.4.4 Penetration

To test penetration:

1. Adjust the system controls to obtain an image that clearly shows the limits of echo penetration as shown in Table 8.2.
2. Measure from the center of the skinline to the deepest vertical position—where the scatter echoes start to break up and tissue definition is lost.

Table 8.2 Imaging Performance

IMAGING PERFORMANCE	C60	ICT	C15	L38
2D Penetration	11.5 cm	6.0 cm	19.0 cm	6 cm

8.5 Additional Performance Tests

8.5.1 CPD

To test CPD:

Note: Use the RMI 425 Doppler Phantom or the RMI 1425A Doppler Phantom.

1. Connect any transducer and set up the system for CPD mode.
2. Press and release **function**.
3. Press and release **0**. The CPD image appears. (In CPD imaging, repeat these steps to return to 2D imaging.)

   To move the CPD image:

   - Use the **trackball** to move the CPD image. While you are moving the CPD image, you will see an outline of the new position moving on the display. When you stop moving, the new position will display the CPD image. (The size of the CPD image is fixed. There is no control with which to change it.)

   To adjust CPD gain:

   - Turn **gain** clockwise to increase the amount of CPD gain. (While in CPD imaging, **near** and **far** affect only the 2D image; they do not affect the CPD image.)
   - Turn **gain** counterclockwise to decrease the amount of CPD gain.
4. Image the vessel using a Doppler phantom. Verify that as the gain controls are increased and decreased, there is a corresponding increase and decrease in the Doppler echo intensity. Verify that there is no flow outside of the vessel.
5. Save a CPD image by pressing **freeze** and then **save**.

8.5.2 PowerMap DCPD

To test PowerMap DCPD:

Note: Use the RMI 425 Doppler Phantom or the RMI 1425A Doppler Phantom.

1. Connect any transducer and set up the system for PowerMap DCPD mode.
2. Press and release **function**.
3. Press and release **0** (twice). The PowerMap DCPD image appears. (In PowerMap DCPD imaging, repeat these steps to return to 2D imaging.)

   To move the PowerMap DCPD image:

   - Use the **trackball** to move the PowerMap DCPD image. While you are moving the PowerMap DCPD image, you will see an outline of the new position moving on the display. When you stop moving, the new position will display the PowerMap DCPD image. (The size of the PowerMap DCPD image is fixed. There is no control with which to change it.)

   To adjust PowerMap DCPD gain:

   - Turn **gain** clockwise to increase the amount of PowerMap DCPD gain. (While in PowerMap DCPD imaging, near and far affect only the 2D image; they do not affect the PowerMap DCPD image.)
   - Turn **gain** counterclockwise to decrease the amount of PowerMap DCPD gain.
4. Image the vessel using a Doppler phantom. Verify that as the gain controls are increased and decreased, there is a corresponding increase and decrease in the Doppler echo intensity. Verify that there is no flow outside of the vessel.
5. Save a PowerMap DCPD image by pressing **freeze** and then **save**.

8.5.3 Image Quality Verification Test

To test the image quality:

- Products that have had subassemblies replaced, or have otherwise been disassembled, must have an Image Quality Verification Test performed.
- The Image Quality Verification Test should be performed after successful completion of *Section 8.3, Setting Up Performance Tests,* on page 78 and *Section 8.5.1, CPD,* on page 80.
- It should be completed before returning the system to service.
- It must be performed by a certified sonographer.

8.5.4 Image Review

Review all saved images and verify that the images are displayed properly.

8.5.5 Printer

To test printer operation:

1. Print two images in rapid succession and verify proper operation.
2. Verify the print control receptacles on the system and on the stand are functioning correctly.

8.5.6 Battery Charging

To test battery charging operation:

1. Insert a battery into the system.
2. Remove AC power from the system AC power connector.
3. Press and hold the **power** switch to turn the system on. Allow the battery to discharge. The battery indicator LEDs (to the right of the display) extinguish from top to bottom as the battery discharges.
   Note: The battery may take 1–2 hours to discharge.
4. Re-attach the AC power cord to the AC power connector.
5. Note that the battery indicator LEDs light from bottom to top as the battery charges.
6. If charging is not evident within 30–60 minutes, refer to **Chapter 6, *Troubleshooting,*** on page 45 for troubleshooting procedures.

8.5.7 Video Output

CAUTION:

- The video output at the video receptacle can only be verified using the recommended video monitor, printer, or VCRs.

To test the video output:

1. Attach an external video monitor to the video connector using the video cable.
2. Turn on the system power and verify that the video on the external monitor matches the video on the system display.
3. If the video does not appear similar, or there is no display on the external monitor, refer to **Chapter 6, *Troubleshooting,*** on page 45 for troubleshooting procedures.

8.6 Returning Products to SonoSite

8.6.1 Contacting SonoSite Technical Support

For technical support of any SonoSite product, do one of the following:

- For US customers, call 1-877-657-8118.
- For international customers, call +425-951-1330.
- Connect to SonoSite on the World Wide Web at www.sonosite.com. Select **Products**, then choose **Technical Support**.
- E-mail service@sonosite.com

You will be asked to provide the following information by telephone or e-mail:

- Contact name and phone number
- Product name
- Serial number
- Description of the problem

8.6.2 Shipping Instructions

A return material authorization number (RMA) is obtained by contacting SonoSite. Contact SonoSite before returning any products.

APPENDIX A

Parts List

This section contains a list of field-replaceable parts.

A.1 Replacement Parts List

The following tables contain all the replaceable parts for the SonoSite ultrasound system. All quantities are one unless otherwise noted.

A.2 Ordering Replacement Parts

To order parts, contact SonoSite Technical Support as indicated in **Chapter 8.6, *Returning Products to SonoSite,*** on page 83.

A.3 Display

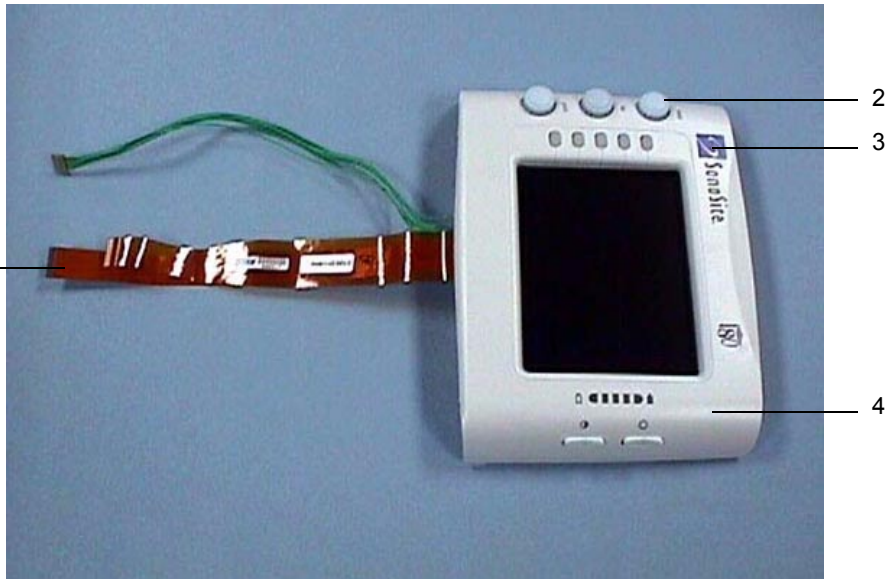


Table A.1 Display

FIND NUMBER	PART NUMBER	DESCRIPTION
	P00747	service assembly, display, sonosite 180
	P01015	service assembly, display, sonoheart
Note: The following parts are available for purchase separately.		
1	P00318	• flex circuit, display
2	P00806	• knob, tgc assembly
3	P00457	• label, sonosite logo
3	P00906	• label, sonoheart logo
4	P00044	• assembly, display, 180
	P00343	• hinge, display
	P00518	• screw, k30x14, cross recess panhead, tf

A.4 Control Panel

Table A.2 Control Panel

PART NUMBER	DESCRIPTION
P00735	service assembly, control panel, english
P00736	service assembly, control panel, french
P00737	service assembly, control panel, german
P00740	service assembly, control panel, italian
P00739	service assembly, control panel, portuguese
P00738	service assembly, control panel, spanish

A.5 Trackball

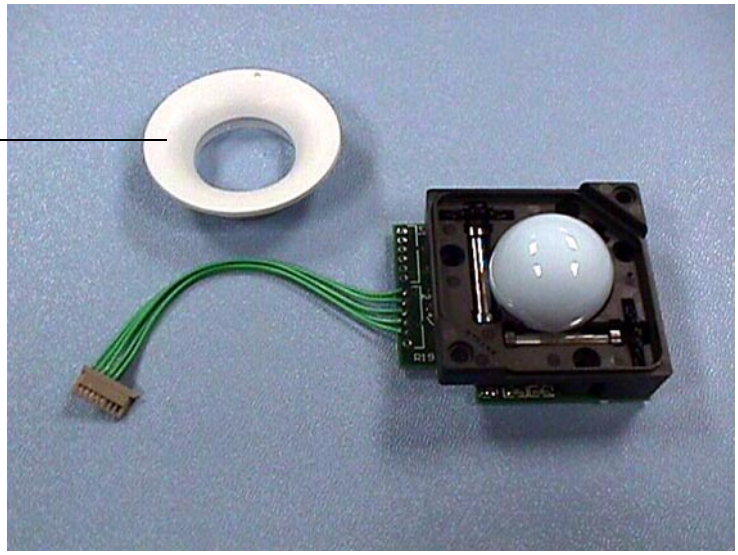


Table A.3 Trackball

FIND NUMBER	PART NUMBER	DESCRIPTION
	P00741	service assembly, trackball
Note: The following parts are available for purchase separately.		
1	P00093	• retaining ring
	P00725	• screw, k25x16, cross recess panhead

A.6 Main PCBA

For replacement procedures, see **Chapter 7.4, *Main PCBA,*** on page 70.

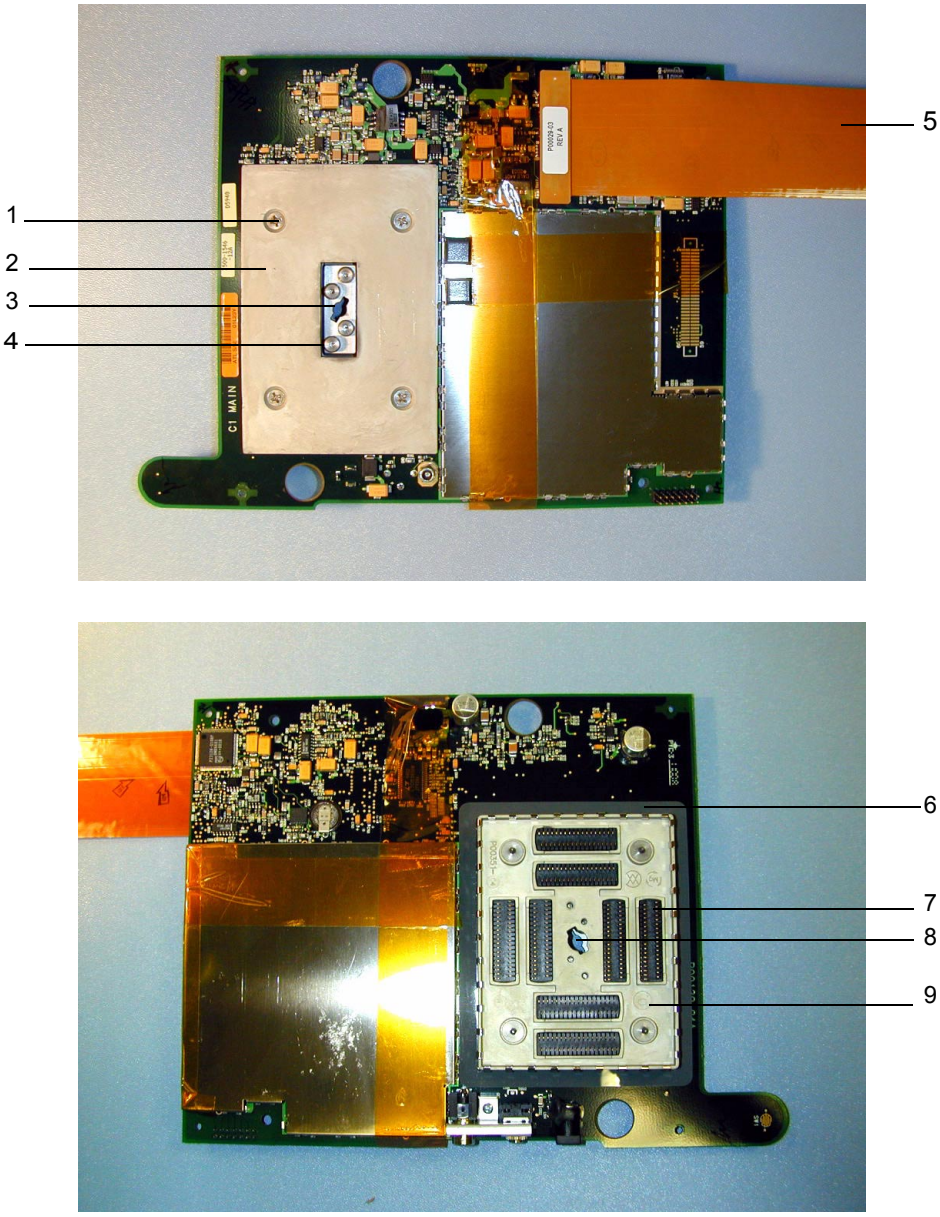


Table A.4 Main PCBA

FIND NUMBER	PART NUMBER	DESCRIPTION
	P03481	Service assembly, PCB C1.8 main Please specific language and system type (SonoHeart or 180) when ordering
	P00346	screw, K25 x 12, cross recess panhead
1	P00441	screw, flathead, 6-32, ss, 3/8
2	P00354	backer plate
3	P00353	wear plate
4	P00524	screw, shoulder, thrust plate
5	P00029	assembly flex circuit, 100-pin
6	P00709	gasket, nest frame
7	P00364	connector, interposer
8	P00646	spring, thrust plate, .047 wire
9	P00351	nest frame assembly, cast

A.7 Power Supply and Power Cable

Table A.5 Power Supply and Power Cable

FIND NUMBER	PART NUMBER	DESCRIPTION
1	P00538	power supply, 85-264 VAC, 50-60HZ, 16V, 45W
2	P00848	power cable, north america

A.8 Video and Printer Cables

Table A.6 Video and Printer Cables

INDEX NUMBER	PART NUMBER	DESCRIPTION
1	P00537	control cable, printer
2	P01167	video cable (rca/stereo)
3	P01111	video cable (rca/rca)
4	P00536	video cable, printer (rca/bnc)

A.9 SiteCharge Dual Battery Charger with Battery

Table A.7 SiteCharge Dual Battery Charger with Battery

INDEX NUMBER	PART NUMBER	DESCRIPTION
1	P00049	battery pack, 6-cell lithium-ion
2	P00552	battery charger

A.10 Additional Spare Parts

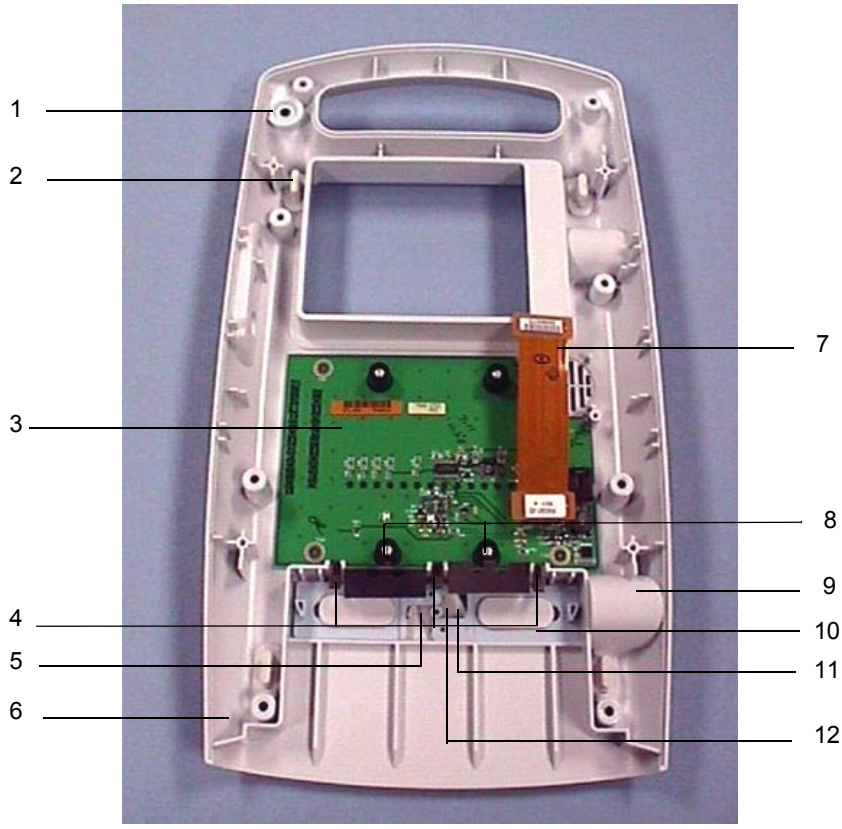


Table A.8 Additional Spare Parts

INDEX NUMBER	PART NUMBER	DESCRIPTION
1	P00104	key, on/off
2	P00361	foot
3	P01036	assembly, pcb, dock interface
4	P00362	contact, battery clip, x3
5	P00360	spring, clip
6	P00110	enclosure, bottom, ui
7	P00301	assembly, flex circuit 40-pin
8	P00640	spring, battery ejection, x2
9	P00356	button, release
10	P00357	slide, release
11	P00358	retainer, slide
12	P00359	pivot, slide

Table A.8 Additional Spare Parts, *Continued*

INDEX NUMBER	PART NUMBER	DESCRIPTION
	P00107	contact, dock interface clip (not shown)
	P00113	enclosure, top, UI (not shown)

APPENDIX B

Service Event Report

The Service Event Report provides information about product failures to the manufacturer and to authorized service facilities, which provide approved warranty services for SonoSite products. For all repairs completed, complete the form and return a copy of it to the following address:

SonoSite, Inc.
Technical Support
21919 30th Drive SE
Bothell, Washington 98021-3904

telephone: 1-877-657-8118 (U.S. customers)
+425-951-1330 (international customers)

facsimile: +425-951-6700

e-mail: service@sonosite.com

website: www.sonosite.com
Select **Products**, then Technical Support.

Service Event Report

SonoSite

Service Provider

Name:	Date:
Company:	
Address:	
Phone Number:	Fax Number:
E-mail address:	

Device Description

Name:	Serial Number:	
Part Number:	Lot Number:	Revision:
Software Version:	Other Identifiers:	

Event Description

Diagnosis

Service Performed

Performed By:	Date:
Actions:	

Parts Removed

Part Name	Part Number	Serial Number	Lot Number	Rev	Replaced By

Parts Installed

Part Name	Part Number	Serial Number	Lot Number	Rev	Replaced By

Tests Performed (attach test data)

Test:	Test:
Performed By:	Performed By:
Result: Pass ☐ Fail ☐	Result: Pass ☐ Fail ☐

Attach additional sheets as required

Index

Numerics

2D performance tests
  axial measurement accuracy 79
  image quality 78
  lateral measurement accuracy 79
  penetration 80

A

AC power
  see also power
  using 30
AC power adapter 74
accessories 2, 22
acquisition subsystem 12
ALARA (as low as reasonably achievable) 8
audible beep
  turning on/off 39
audience 2

B

battery
  charge indicators 19
  charging 35
  checking 35
  diagnosis figure 53
  failures 47
  installing 29
  release 15
  removing 28
  safety 7
  specifications 24
  storage and shipping 23
battery charger
  See SiteStand dual battery charger
battery charging
  test 82
battery pack
  operating specifications 19
biological safety 8

C

C15/4-2 MHz 15mm 1
C60/5-2 MHz 60mm 1
cables
  video 21, 22
cautions 6
cine arrows and freeze controls 15
cleaning and disinfecting 43–44
  precautions 43
Color Power Doppler
  adjusting gain 80, 81
  see imaging modes 1
contaminated materials
  receipt of 43
control panel assembly 60
  failures 46
  removing 60
  replacing 63
  required parts 60
  required tools 60
control subsystem 12
controls
  optimize 15
conventions 2

D

date and time
  setting 39
default settings
  changing to 41
depth 15
diagnosis figures 45
disinfectants
  recommended 44
display
  diagnosis figures 48
  failures 46
display assembly 55
  removing 56
  replacing 58
  required parts 55
  required tools and materials 55
display subsystem 12

E

electrical
  safety 5
  specifications 23
electrostatic discharge (ESD) 6
environmental specifications 23
equipment protection 7
error message 6
  what to do 6
external power 19
  power supply 20

F

far 15

fetal tables 22

function keys 15
- setting up 41

G

gain 15

grace period 3
- time remaining 3

H

humidity limits 23

I

ICT/7-4 MHz 11mm 1

image
- quality verification test 81
- review 81
- storage 23

imaging
- modes specified 22

imaging modes
- 2D 1
- Color Power Doppler 1
- PowerMap Directional Color Power Doppler (DCPD) 1

introduction 1–33

IrfanView software 16

K

keyboard
- diagnosis figure 50

L

L38/10-5 MHz 38-mm 1, 22

labeling
- symbols 9

license key 3
- installing 33
- obtaining 3, 32

license update screen
- displaying 35

M

main PCBA 69–74
- failures 46
- removing 70
- replacing 71
- required parts 69
- required tools 70

menu controls 15

monitor 22
- brightness 15
- contrast 15
- external diagnosis 49
- external setup 41
- specifications 22

moving image 80, 81

N

near 15

P

parts list 85–95
- additional spare parts 94
- control panel assembly 87
- display assembly 86
- main PCBA 89
- trackball assembly 88

patient 15

performance tests 77–83
- overview 77
- peripheral output 82
- printer 81
- required test equipment 77
- video output 82

peripherals 22, 75
- monitor 75
- printer 75
- VCR 75

phantoms
- PFS-A-3-1-G2 UHDC Flow System (Doppler) 77
- RMI 1425A Doppler 77
- RMI 403 GS Multipurpose 77
- RMI 413A Soft Tissue 77
- RMI 425 Doppler 77

physical dimensions 22

power
battery charge indicators 19
battery pack 19
connections 20
external 19
line cord specifications 21
subsystem 13
supply 20
switch 15
turning off 30
turning on 29
power delay
setting 39
PowerMap Directional Color Power Doppler (DCPD)
see imaging modes 1
printer control 21
printers
setting up 40
test 82
processing subsystem 12
product failures
reporting 97
products
returning 83

R

replacement parts
list 85
ordering 85
replacement procedures 55–75
return material authorization number (RMA) 83

S

safety 5–10
battery 7
biological 8
electrical 5
equipment protection 7
labeling symbols 9
see also system 1
service event report 97
form 98
setup and operation 27
shipping
instructions 83
shipping specifications 23
SiteCharge dual battery charger 74
indicator light table 37
using 37
SiteLink Image Management software 16
SiteStand 15
figure 17
SiteStand monitor 16
sleep delay
setting 39
software
IrfanView 16
licensing 3
SiteLink Image Management 16
upgrading 31
SonoSite system
description 1
SonoSite technical support
contacting 83
standards
airborne equipment 25
electromechanical safety 24
EMC/EMI 24
storage
image 23
specifications 23
subassembly
replacement 45
symbols, labeling 9
system
charging requirements 19
components 1
controls 13
depth 22
description 1
diagnosis figure 52
dimensions 22
height 22
measurement accuracy 79
overview 11–24
software 3
specifications 22
temperature limit 23
transducers 1
turning off 29
turning on 29
waking up 30
weight 22
width 22
system and subsystem
diagnosis 45
system information screen
displaying 34
system setups
using 38

T

theory of operation 11–13
trackball
  diagnosis figure 51
  failures 46
trackball assembly 64
  removing 64
  replacing 64, 67
  required parts 64
  required tools 64
transducer 22
  acquisition subsystem 11
  C15/4-2 MHz 15mm 22
  C60/5-2 MHz 60mm 22
  connecting 27
  ICT/7-4 MHz 11mm 22
  removing 28
  servicing 74
  specifications 22
troubleshooting 45–53
  failures 46
  test equipment 45

U

universal precautions 43
user interface subsystem 12

V

VCRs
  setting up 40
video 21
  cable signals 22
  internal 22
  output tests 82
video output
  configuring 21
  NTSC 21
  PAL 21

W

warnings 5
with 17

Z

zoom 15